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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1102 16th Street, N. W., Washington 6, D. C.

VOLUME XXXVIII NO. 3

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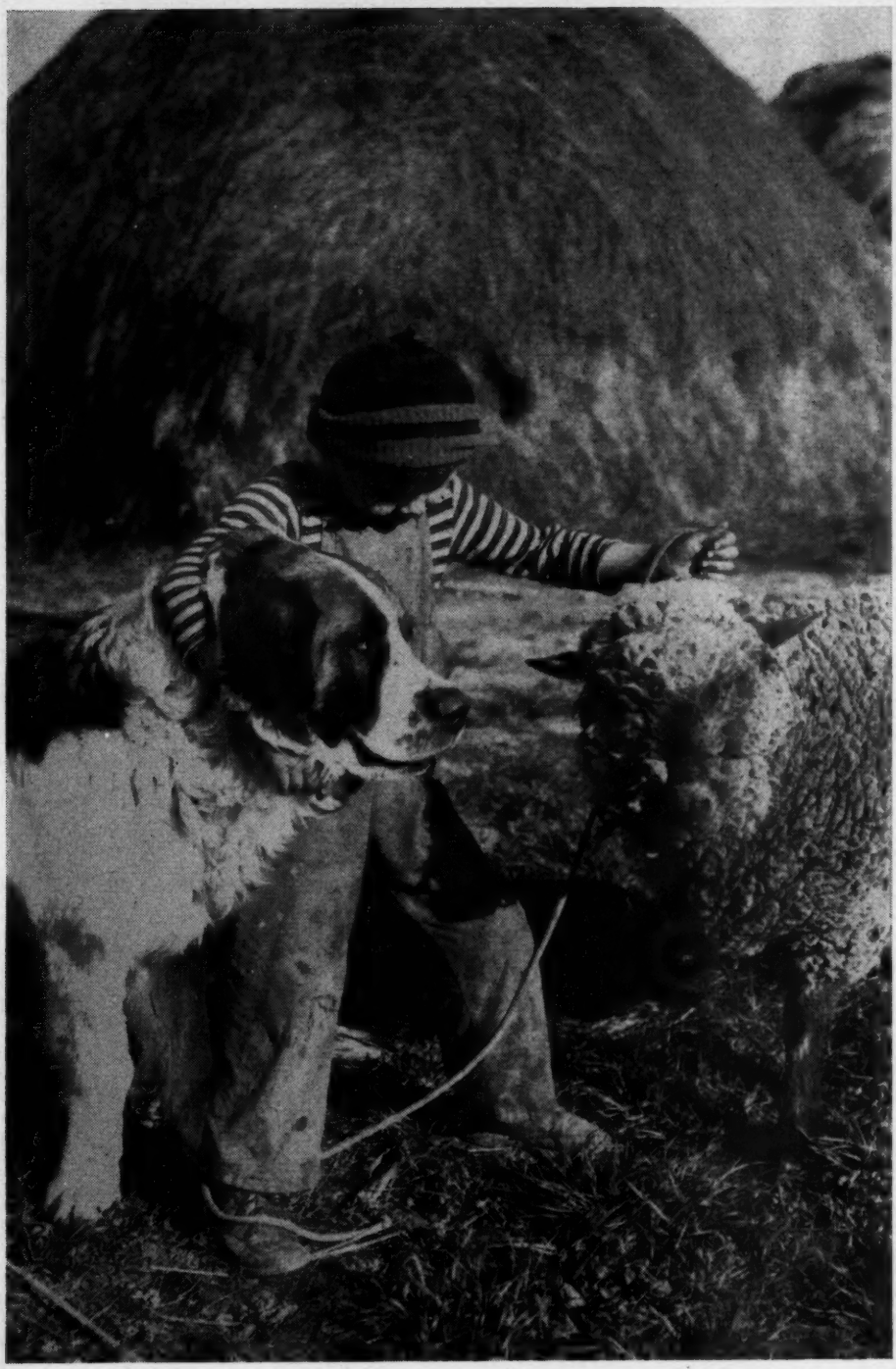

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VOL. XXXVIII WASHINGTON, D. C. MARCH 1954 No. 3

Let's say more often . . .

"Make Mine Milk"

Jeff McDermid

HOBNOBBING again with old cronies in the Midwest milky way, who are no less bewildered than I am over the dilemma of the dairy, it may be a good time to look into the lactic a little. I say this advisedly, knowing that many have surveyed and studied and pondered ere this to unravel what has been called a riddle in the affairs of the herd-owner. To any unbiased observer it seems more than strange that a product like milk is in a muddle. Milk products furnish 75 per cent of the lime or calcium to build baby bones and strengthen those of the elderly, 45 per cent of the riboflavin, 15 per cent or more of vitamin A, and 25 per cent of the protein in the general food supply of the nation.

Milk is nowadays produced and marketed in a highly pure and sanitary manner throughout most of this broad land, and can be had for the asking in convenient form and proper volumes. From milk and cream come some of the most delicious dishes known to mankind, and colored pictures and food folders galore coax the housewives to jar jaded appetites with dairy tidbits. More firms than ever before, specializing in year-around and holiday packages of cheeses of multiple varieties, are pushing their sales along the roadside. Doctors and clinics recommend dairy foods for many ills and weaknesses. More dairy and milk-producing organizations than we have ever had on the scene are active now.

Yet we bump right into a roadblock

and scratch our heads about the best way to blast it out of the path or detour around it safely. Sometimes it just doesn't seem to make sense—but we deal with nasty facts, not theories, one of which is that Mr. Consumer's habits have changed and Mr. Competitor is on our tails.

Because of its widespread use and the need for strict sanitary practices in its production and distribution, milk affects the public welfare and is subjected to public regulation at local, state, and federal levels. Many of us can remember vividly when this was decidedly not so. Few of us would want to go back to the fly-specked dispensing pitcher in those "free times" when milk and water supplies were untouched by any civic or public restrictions and safeguards.

YET it costs good, hard money and much labor to abide by the regulations, which are covered as follows in an early decision of a Midwest supreme court: "There is no article of food in more general use than milk, and none whose impurity or unwholesomeness may more quickly, more widely, and more seriously affect the health of those who use it. The regulation of its sale is an imperative duty that has been universally recognized."

Of course, there are instances where extreme and illogical attempts at milk-trading regulations have been denied by high courts because of being arbitrary and unreasonable. Very often certain subterfuges are advanced in the light of sanitary precautions, which upon close examination prove to be schemes to narrow the boundaries of a given market to protect the "vested interests" within its zone. Often these work against sound public relations.

Production that temporarily happens to be in excess of the current demand at prevailing prices has always been a problem for dairymen, whether they are producing for city fluid milk markets or for manufactured articles. Back in the 1933-34 depression, such a surplus led to "chiseling" by outlying producer-distributors or even by licensed city dealers. Then the problem of the states and the federal regulators was to set a going price and halt the trend to a lower price. The situation has been reversed in recent years.

Since Congress enacted the Steagall price-supporting theory for nonbasics like milk, it has been customary to urge a firm support price at 90 per cent of parity, or fair exchange value. This persistence for that level continued in 1953 in the face of some of the largest increases in milk flow known to the Midwest—although to be exact, only four or five states showed less total milk production through most of last year than they produced in 1952.

NOW the efficient dairy farmer was not to blame—if we persist in calling a surplus something to be blamed for making. (A land flowing with milk and honey has always been regarded as a highly desirable and delectable place to pitch your tents.) Added to the milk farmer's own acquired ability in handling his herd well and using productive, proven sires, we had other reasons in the picture for the swollen volume of lactic wealth.

Beef cattle prices shrank, and a once good outlet for culls from the working dairy herds went to pieces. Veal was also hit. Hence there was less culling and more calf rearing. The weather conditions over much of the heaviest milk territory favored grass and feed crop harvests. Somewhat lower feed prices encouraged much heavier rates of feeding, plus the general abundance of pastures, with some notable exceptions.

Along with these rather natural incentives for more milk, there was much shifting from outlying markets to the generally higher paying fluid milk markets, particularly those under federal orders. In a few months of early 1953 there was an increase of nearly 4 per cent in the number of producers and almost 15 per cent in the average daily deliveries by producers on these usually more attractive markets.

For a while butter storages were swamped and the main out-of-storage movement represented what little could be sold in the face of difficult price competition. Soon the main flow of butter was directed to the warehouses leased by the Commodity Credit Corporation, which has become in 1953-54 the biggest buyer of butter in the world. Cheese, likewise, felt the pinch and far more than a healthy, normal volume was shunted into the federal storages.

NOW, all this has been cussed and discussed over and over and ranted about and raved against, and the dairy industry has been warmly berated for not bobbing back with a sure-fire solution to the recent program of production for government holdings. Of course, less than 6 or 7 per cent of the annual milk flow has been kept cooped up that way, but it's enough to look bad and bad enough to triple the sale of aspirin in the dairy belt. The worst thing about it is not the federal money involved but the customers lost. Whether the recent rule to drop the support level to 75 per cent of parity will coax back some customers is not certain. It might if a lot more give-away loss-leaders are tossed into the retail channels. The drawback here is that even 50-cent butter won't halt the smart and flexible competition from substitutes entirely. For another thing, getting rid of what we have already produced so freely and generously may not have much of any subsequent effect on the future floods of milk to come.

Dairy farmers, as well as other livestock raisers, are no doubt in for quite some enlargement of the grass lands area and the accompanying increase in potential production, to say the least. The South is preparing as never before to go beyond its long era of merely localized, self-sufficing milk production and expand to a volume that must gradually begin to compete with the present surplus dairy regions. So the next best bet, they all clamor, is to invest in strong and well-directed publicity and advertising campaigns. Yet in that field also, there are competitors, and the element of attractive prices plays its usual telling role.

To be sure, this is no reason to doubt the value of keen and repeated advertising. Several successful projects of this kind are being held up as worth imitation, inasmuch as they really got some dues-paying converts who happened to come along just when coffee was up for a little discipline.

It has also been urged by many in high places that the real key to universal relief and satisfaction in the dairy game would be to rush right into the wonderful fluid milk market. One need not spend much time and the company's print paper to go deeply into that proposal.

COMPARED to the estimated gain last year of all agricultural commodities over 1939 production, somewhere around 45 per cent, the increased milk production has been placed at 10 per cent. Meanwhile, the national population is 22 per cent greater. This spells a decreasing inclination to consume milk, but the main fact is that most of the decrease is registered in butterfat rather than whole milk, while the non-fat solids show distinct gains in recent years.

Making up this decline in butterfat are such factors as somewhat lower average fat content of fluid milk and a sharp cut in fluid cream consumption, a desire to avoid fatty diets, substitution of vegetable fats in filled milk and frozen desserts in place of butter. Another probable reason is the price difference be-

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Peanut Production Trends in North Carolina

By Astor Perry

Department of Agronomy, North Carolina State College, Raleigh, North Carolina

THE recent peanut referendum, authorized by the 1953 General Assembly, emphasizes the point that peanut farmers in North Carolina are becoming aware of the many problems that confront them. In this referendum the peanut farmers voted to assess themselves 1 cent for every 100 pounds of peanuts marketed during the 1953, 1954, and 1955 crop years. When the vote was in, it was not surprising to find that 98% of those voting in the referendum favored the assessment. There is quite a story connected with the referendum and it is comforting to know that when the American farmer is aware of a situation, he will take steps to remedy it. That was the case with peanuts.

Many warehouses were filled with the 1951 and 1952 crops of peanuts, the majority of these being held by the Commodity Credit Corporation. In all, the CCC held over 120,000 tons of the Virginia type peanuts and there was very little prospect of these moving out into commercial channels. The outlook for the sale of the 1953, 1954, and 1955 crops, therefore, was not very bright. Leading peanut farmers in the State were well aware of this situation, and in a commodity meeting of the State Farm Bureau Convention, the subject was discussed and ways and means to help alleviate the situation were brought up for consideration. Soon after the convention, an organizational meeting was held and the North Carolina Pea-

Fig. 1. A general scene of a field of peanuts in eastern North Carolina.

nut Growers' Association was incorporated.

After the 1953 General Assembly passed a special enabling act, plans and means of organizing the growers were discussed. It was finally decided that the best way to ease the situation was to conduct a referendum and have the peanut growers vote on the question of whether to assess themselves 1 cent per 100 pounds of peanuts sold for the following three years. The money collected from such an assessment was to be used to promote the sale, use, and consumption of peanuts and peanut products. The press, radio, and various agricultural organizations of the State were very helpful in informing the farmers about the referendum and the purposes of the North Carolina Growers' Association. Thus the growers of another farm commodity have organized to help themselves. The Association has now employed a full-time executive secretary whose sole responsibility will be to promote peanuts through various means.

Other problems also concerned the peanut grower, for this is the crop that has been known for a century as the "unpredictable legume." It is, however, not very difficult to predict the average State yield for any given year. The average State yield during the past 50 years has been around 1,200 pounds per acre, and there have been very few fluctuations in this figure. It seems that regardless of dry weather, wet weather, or other unfavorable weather conditions, for the State as a whole, the average yield of 1,200 pounds per acre will be obtained. What is hard to predict, however, is what effect a given practice will have on the yield of the peanut. A carefully observing farmer will notice that a neighbor is getting a higher yield than he is, and when he compares his production practices to those of his neighbor, he can find only one slight difference. The next year he will employ this new practice and it may result in increased yield, but the following year his yield may go down again, while his neighbor's yield still stays up. Apparently then there were other factors which were not detected. It has been learned by many farmers that the only sure way to increase yield is to follow all of the improved practices, and sometimes these fail to increase the yield consistently over a period of years. As more and more is learned about the

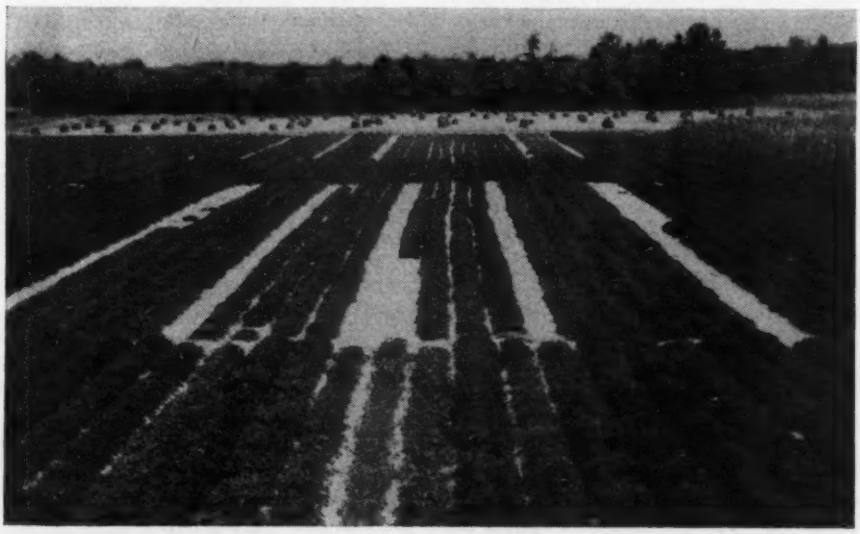

Fig. 2. A view of the peanut experimental plots at Rocky Mount, North Carolina.

Fig. 3. Applying a topdressing of landplaster to peanuts at early flowering time.

basic commodity, however, it seems likely that the adoption of approved practices will almost always pay off.

There are two bright new stars among peanut varieties in North Carolina this year. After extensive tests, the North Carolina Experiment Station released the first two varieties to result from a planned hybridization program. These were named NC-1 and NC-2. Both of these varieties had shown up well in Experiment Station trials and in county agent variety tests, but it was not anticipated that they would create as much interest as they have. Market value of both have been very high, and in most cases gave a price increase of $1.00 per bag over farm stock varieties. The demand has been so high for the seed of these varieties that growers have been very reluctant to release seed to anyone but their neighbors, and it is estimated that if all the seed of these varieties were planted this year, only 7 to 8% of the North Carolina acreage would be in certified peanuts. Fortunately, none of the seed of these new varieties have been sold in commercial channels and this percentage may be obtained. The certified seed supply for the 1955 crop year will be adequate, however.

NC-2, in addition to being a good producer with high farmer appeal, has also shown a high degree of resistance to Southern stem rot. Since this disease is quite prevalent in several of the peanut counties, demand for this variety has been exceptionally high.

Several new strains resulting from plant hybridization are being tested, and one of these which is showing up better than either NC-1 or NC-2 in Experiment Station trials is being increased as foundation seed this year. If it continues to show up as being better than either of the new varieties, it will be released within the next two years.

The rotation of peanuts with crops resistant to nematodes and Southern stem rot is also being employed by many farmers with excellent results. Crops recommended for rotation with peanuts are corn, small grain, and cotton. Tobacco and most varieties of lespedeza and soybeans build up nematode infestation and are to be avoided in the peanut rotation. A three-year rotation of this type not only decreases damage from insects and diseases, but also helps maintain a high fertility level of the soil.

Soil tests are recommended as a general practice, and the growers should follow the recommendations. In general, however, applying adequate amounts of calcium and potash will be sufficient. Calcium needs are supplied by applying lime prior to planting or by topdress applications of landplaster at early flowering time. Since landplaster does not change the acidity of the soil, it should always be used in place of lime or potash-lime, when the pH is above or approaching 6.3. Extensive tests have shown that the best method of applying potash is to apply it to crops in a rotation preceding peanuts. For example, it is much better to apply 80 lbs. of K_2O to the cotton crop preceding peanuts than to apply 40 pounds to the cotton and 40 pounds to the peanuts. Potash may be applied also by broadcasting 100-150 pounds of muriate of potash before breaking the land.

The general tendency has been for the farmers to increase the plant population per acre in the past few years. The standard row, up until three or four years ago, was 36 inches for bunch type and 42 inches for runner type. It has been found, however, that where the equipment is adaptable, row widths of 24 to 30 inches with bunch peanuts and 36 inches with runner peanuts have resulted in increases of 400 to 500 pounds per acre.

The rotary hoe has been used for a good many years in North Carolina, but until recently, it was not used to any large extent in the cultivation of peanuts. It is now known as the easiest and least expensive method for this crop. The first cultivation should be before the peanuts emerge from the soil. The procedure should be repeated every four or five days until the plants begin to bloom. The effectiveness of the cultivation is greatly increased by using sweeps in the middle. The rotary hoe must be operated at a speed at least 5 miles per hour to be effective.

In many areas of the State, Southern corn rootworm has caused considerable damage to peanut pegs and pods. The larvae of this insect, in many cases, bore into the young pegs as they penetrate the soil, thus killing them. The farmer, upon digging the peanuts in the fall, fails to see the wrinkled pegs and usually blames the trouble on dry weather. Most of the damage comes from the boring of the larvae into the growing or mature peanut pods. The

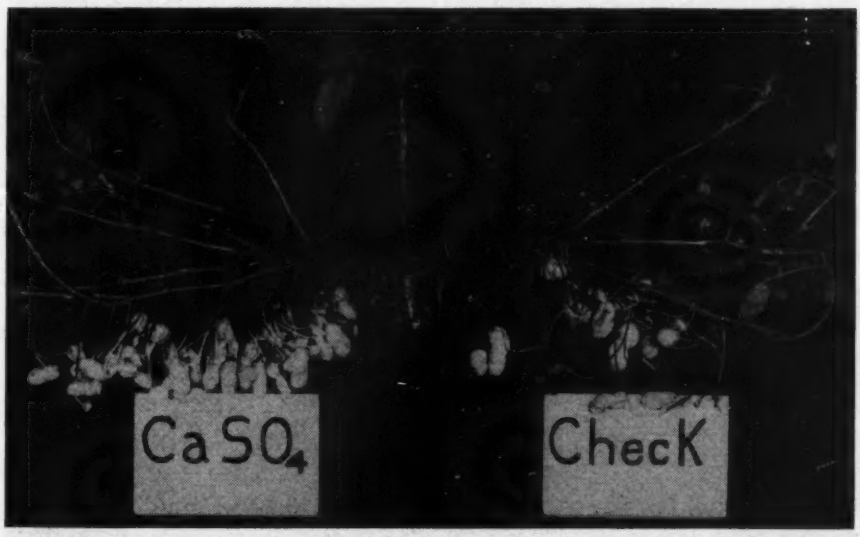

Fig. 4. This shows the effect of applying $CaSO_4$ to one side of the plant. Calcium is not translocated to the pods.

larvae bore into the pod and feed upon the young seed. If not successful in destroying it, they have left an excellent entry for many of the fungi and bacteria. The larvae of this insect can be controlled easily by using 2 pounds of actual Aldrin or 1½ pounds of actual Heptachlor per acre. These materials are available in either dust or in granular forms and should be applied at the time of the first cultivation.

It has been known for a good many years that the majority of farmers applied landplaster as an insurance against "pops" and unsound kernels. This is a cheap insurance factor and should be followed because during unfavorable weather conditions, the developing pods may not be able to get enough calcium even though the soil pH is adequate (5.9 to 6.2). For best results landplaster should be applied during early blooming stage at the rate of 400 pounds per acre and should be broadcast directly on the plant. Since calcium is not translocated in the plant, landplaster applied on one side of the plant will have very little effect on the nuts forming on the other side.

The market quality of any variety of peanuts may be lowered considerably by harvesting before the majority of the pods are mature. With most varieties under normal conditions, it has been found that a period of 5 to 5½ months is required for peanut production. This means that peanuts planted the first of May will be ready for harvest during the first part of October. Unusual weather conditions may change this period to some extent, but in all cases, harvesting should not begin until the maximum number of pods are mature. The use of good stack poles with slats 15 to 18 inches off the ground to hold the peanuts up and allow air circulation has proven to be an excellent practice during the past few years. This allows the peanuts to get air circulation from below and for the pods of hay to dry quicker and brighter.

Even though 1953 was a very dry year, the State average will be several hundred pounds above the 50-year average. Most of this has been due to the incorporation of the above approved practices into the farming program. Yields as high as 5,000 pounds per acre have been obtained on the Experiment Station. With the farmer aware of his many problems, and with the extensive educational program now in progress,

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Fig. 5. Showing the effect of rootworm injury to mature pods.

Fertility of Georgia Soils as Shown by Soil Tests

By Joel Giddens

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TESTING a large number of soil samples from different areas of Georgia has shown a difference in fertilizer needs in those areas. Improved fertilizer recommendations can be made on the basis of soil tests. As the soils have different nutrient needs, grades of fertilizer should be used in each area that will best fit these needs. It must be kept in mind, however, that data from the different areas were obtained from an average of samples tested, and to be more certain of lime and fertilizer needs, the farmer should have samples from individual fields tested.

Procedure

Soil test results from more than 35,000 samples of soils from all areas were used in the summary. There were sufficient samples from each area to give adequate representation of the State. Samples from problem areas, gardens, lawns, and those of insufficient cropping history were eliminated in this study. The samples used came from cultivated soils. Soils of wooded or forest areas likely would have different values.

The soil pH values were determined by using a glass electrode and placed into acidity groups that represent the usual range of reaction for Georgia soils.

The percentage of organic matter was determined by a wet oxidation method after passing a 20-mesh screen. Samples were grouped into: (1) very low—those below 1%; (2) low—1.0 to 1.5%; (3) medium—1.5 to 2.0%; and (4) high—above 2.0% in organic matter content.

The available phosphorus was determined colorimetrically after extracting the soil with dilute hydrochloric acid containing ammonium molybdate. The available potash and calcium were determined turbidimetrically after extracting the soils with a 22% sodium perchlorate solution. The results of the tests for these nutrients were tabulated according to whether they fell into low, medium, or high fertility groups.

The soil test data were summarized by counties and soil area groups. Only data for the soil area groups are used in this report. The amounts of P_2O_5 and K_2O fertilizers used in each county and area were calculated from data supplied by the State Department of Agriculture. Production and Marketing Administration data for lime distributed through the agricultural conservation program during the period 1941-48 were used. From this information the amounts of P_2O_5, K_2O, and limestone used annually per acre of cultivated land were calculated for each soil area in Georgia.

Results and Discussion

The fertility status of Georgia soils as determined by the summary of the soil test data is illustrated in Figures 1 through 5.

Soil Acidity

The majority of cultivated Georgia soils falls in the medium acid range of pH 5.5 to 6.0. The greatest percentage of acid soils occurs in the Lower Coastal Plain area. This may be explained partially by the fact that many soils in this area are poorly drained. The great-

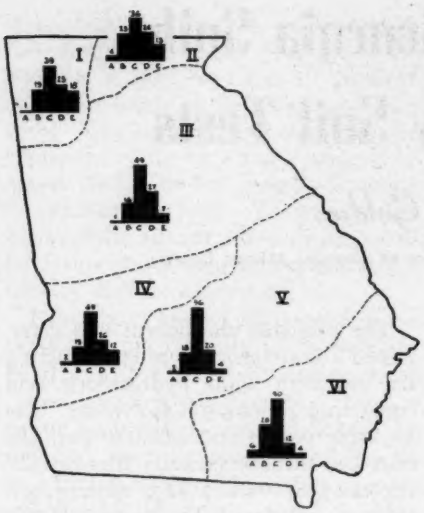

Fig. 1. Percentage of Georgia soils in various pH groups 1945-51. I. Limestone Valleys and Uplands; II. Mountains; III. Piedmont Plateau; IV. Upper Coastal Plain; V. Middle Coastal Plain; VI. Lower Coastal Plain. pH Groups—A. Below 5.0; B. 5.0 to 5.5; C. 5.5 to 6.0; D. 6.0 to 6.5; E. Above 6.5.

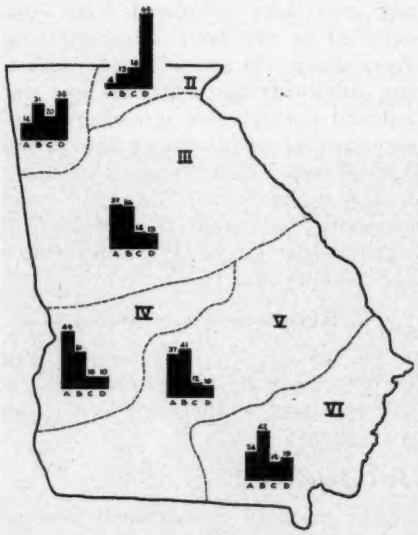

Fig. 2. Percentage of Georgia soils in various organic matter groups 1945-51. I. Limestone Valleys and Uplands; II. Mountains; III. Piedmont Plateau; IV. Upper Coastal Plain; V. Middle Coastal Plain; VI. Lower Coastal Plain. Organic Matter Groups—A. Below 1%; B. 1.0 to 1.5%; C. 1.5 to 2.0%; D. Above 2.0%.

est percentage of soils in the high pH range occurs in the Limestone Valley and in the Mountain areas where heavier applications of limestone have been made (Figure 5). Limestone applications are responsible for most soil pH values above 6.0 in any part of the State.

Soil Organic Matter

Mountain and Limestone Valley soils are higher in organic matter than soils of other areas in Georgia. This is due in part to the greater proportion of bottom land soils and soils of heavier texture being used for cultivation. The mean annual temperature may also have an effect on the organic matter content of these soils. The mean annual temperature in the southern part of Georgia is approximately 10°F. higher than that of the northern part of the State. This increases the possibility of a more rapid oxidation of soil organic matter in south Georgia. A large number of soil samples from the Upper Coastal Plain fell in the low organic matter group. Many samples came from the Sand Hills and severely eroded areas. The greatest percentage of samples from the Coastal Plain and Piedmont areas was in the low organic matter range, 1 to 1.5%.

No summary has been made of the nitrate content of Georgia soils. Nitrates are readily leached and may vary in soils from day to day. As the soil organic matter content of cultivated Georgia soils contains about one-twentieth nitrogen, one may use organic matter values as an indication of the total nitrogen in these soils. There are, as a matter of fact, few soils in the State that do not respond to nitrogen fertilization.

Phosphate

The amount of available (dilute-acid soluble) phosphorus in Georgia soils is generally less in the Mountains than in the Lower Coastal Plain. Soils in the Upper Coastal Plain and Piedmont

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Fig. 1. Fields are rarely completely chlorotic. In this case, three rows are chlorotic. The rest of the field is free of chlorosis or only mildly chlorotic in spots.

A New Spray for the Cure of Lime-induced Chlorosis

By W. T. McGeorge

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THE bulk of the mineral fraction of a plant is composed of a relatively small number of elements which we often refer to as major nutrients. In addition to these major elements, and no less essential, there are others which the plant must have for normal growth. Among these the so-called trace, minor, or micro-nutrient elements are important. Iron, manganese, and zinc are prominent members of this group. They have been classified as micro-nutrient elements because of the small amount needed by plants—in fact in excess they are usually toxic.

Chlorosis

When available forms of these elements are deficient in the soil or when a physiological condition arises, within the plant, which interferes with their activity or utilization, chlorosis develops. Chlorosis is defined as a loss of green coloring matter, chlorophyll, in the leaves. It occurs in all degrees of severity ranging from faint yellowing of the leaves to dieback of the plant. The chlorotic pattern is related to the type of deficiency and so we have the iron, manganese, zinc, and other deficiency patterns.

Fig. 2. Boer love grass: Right, check untreated; left, sulfur was applied at the rate of one ton per acre.

Calcareous Soils

In the Southwest the highly calcareous nature of the soil is a major contributing factor in the prevalence of chlorosis, and a great deal of research on this problem has been conducted in Southern California, New Mexico, Texas, and Arizona where such soils exist. In most cases the chlorotic problem in this area is an iron deficiency problem. It is not a situation in which there is a deficiency of iron in the soil. This has been proven by the analyses of hundreds of leaf samples for iron content. In other words the plants seem to take up an ample supply of iron from the soil but it becomes inactivated in the roots, stem, and/or leaves. In this inactivated form it is immobile within the plant and therefore not sufficiently active to perform the function of catalyst—a function generally ascribed to iron and some of the other micro-nutrients. The failure to function as such results in the development of chlorotic leaf patterns.

Soil Correctives

A number of procedures for curing chlorosis have been recommended by soil scientists and plant physiologists. Obviously the permanent cure is acidulation or reduction in pH of the soil, using such materials as sulfur, organic matter, iron sulfate, sulfuric acid, or other acidulating agent. The theoretical basis for this recommendation is that the calcium carbonate alkalinity is a contributing factor and a reduced pH will reduce the influence of this type of alkalinity.

Many attempts have been made to cure the trouble by adding soluble salts of the micro-nutrients to the soil. Because of the high pH and calcium carbonate alkalinity of the soil, the elements are rapidly precipitated in an insoluble form. As such they are no more available to the plant than the natural supply already existing there.

Acidulation or reduction in pH of an alkaline-calcareous soil is an expensive operation and except for high-priced crops is not considered economical—that is, within the limit which will still allow a reasonable profit to the farmer for his crop. There is another reason why the soil scientist is often re-

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Some Aims of Soil Research

By Wm. A. Albrecht

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MUCH as the definition of research depends on the person doing the defining, so the aims of research may depend on the one who is aiming. If we limit our discussion to research in the strictest sense of the term, we may define it as the addition to the sum total of our knowledge already recorded. In many cases research is said to be the effort resulting in a discovery. But too often what someone believes he has discovered is a discovery only for him. It may be an addition to his knowledge, but by that token for him it is not necessarily an addition to the total of knowledge. Learning by one of us, or the discovery by some of us, of facts already within the sum total of knowledge, is not research. For that reason in cases of claims for credit for research, the question of knowledge already recorded (preferably by the printed page) serves to establish priority and classification as true research. Other methods of record can also serve.

For our purposes here, let us exclude from true research the repetition of previous researches for greater refinement, and of facts already established and reported. Modern techniques of measurement permit refinements today which were not possible a short time ago. For example, in animal feeding trials in low winter temperatures and those higher in summer, and in animal calorimetry, it was established long ago that the animal accommodates itself, by means of extra feed, to temperatures going downward below 70°F. But the animal cannot accommodate itself so readily to temperatures going upward above 70°F. Now with modern refrigerator aids and heating apparatus, it is possible to study the animal's physiology by increments as small as a degree or two, and thus refine the basic facts of former research. This repetition under more refinement scarcely is research unless it adds new facts and new principles, or it shifts the temperature figure previously established.

Research in its evolution of new knowledge usually includes four steps or four phases, namely (a) observations, (b) theories prompted by those observations, (c) experimental tests of the theories, and (d) conclusions drawn from the results of the tests. If any of these phases are omitted, if any are out of proper sequence, or if any are in error, a new fact or new truth will not be established, and thereby the efforts fail to be research in the stricter sense. Research must represent a new theory, a new idea, some new causal connections, new explanations, and new results.

A few of the aims of some soil research, rather than what soil research in total is aiming to do, may be briefly outlined here.

Colloidal Clay Suggested Itself as the Dynamic Soil Separate in Plant Nutrition

For many years our soil research at the Missouri Station has aimed to understand how the soil can hold the plant nutrients in sufficient supply for an entire season of crop growth when the same nutrient supply, if put into a solution as plant growth medium, would demand—for the necessary dilution—more water than the soil could retain within root reach. If put into solution in the water within root reach,

the resulting high salt concentration would kill the seedlings.

As another aim in soil research, the dynamics of ionic adsorption and exchange suggested the theory of a contact area of the colloidal root and colloidal clay as the center of the chemo-dynamics by which nutrients are held in quantity and exchanged to the advancing root, which is offering for them the active hydrogen originating in root respiration. Cations in exchange are under a growing comprehension, but anionic behaviors are still uncomprehended.

Fortunately, for these aims, some funds which had accumulated from the sales of legume inoculation, and an able young Swiss chemist reluctant to leave the United States after the expiration of his scholarship visa, were the combination to facilitate the testing of the colloidal clay-root contact hypothesis, in spite of the aspects of soil bacteriology, plant physiology, and biology, in general, then still strange to this Swiss scientist of promise. Here was the first research aiming to shift the concept of plant nutrition from the hydroponics demanding dilute and repeatedly replenished solutions to that of nutrient adsorption on the clay and then exchange from there to the plant by the colloidal clay-root contact.

With the claypan soils, or the planosols, covering such extensive areas but considered such problem soils in spite of their mechanical suitabilities, they were hypothetically considered as having advantages in research and in practice. They were so considered because of the amount of the claypan in the profile and the nature of its clay, when this soil separate is viewed as the seat of much chemo-dynamics for plant nutrition according to this newer concept. It seemed logical, therefore, to aim the research at this clay as the first one of the three soil separates to be studied independently of the others, i.e., the silt and the sand fractions. It was the aim to envision and comprehend the chemo-dynamics between the finest clay fraction—capable of more complete standardization in chemical behaviors—and the advancing plant root. Here soil and plant nutrition as cause and effect, respectively, were envisioned in the most limited soil area for control and study in research.

It was by means of the electrodialyzed clay of smallest particle size that there was demonstrated the movement of the hydrogen, a non-nutrient, from the root to the clay. Other cations, both nutrients and non-nutrients, were shown to be going from the clay to the root and even in the reverse direction, namely, from the growing root to the clay in the substrates. These researches gave opportunity for, and birth to, many more theories and hypotheses for experimental testing. That soybean plants grown to the significant size considered a hay crop should be discovered to contain less nitrogen, less phosphorus, and less potassium than the planted seed (and at about the time when this newer crop was being propagandized as "a hay crop but not a seed crop") gave impetus to several more theories about soil and nutrition. One could aim soil research, then, not only at the nutrition of plants, but at the nutrition of animals compelled to eat any quality of vegetation so commonly included under the term "hay."

Like many other research tools, the colloidal clay was a new means of more refined control (a) of pH, (b) of the degree of ionic saturation of the clay, (c) of the ratios of these saturations by different ions to each other, (d) of the influence of these ratios on the ionic activities of the adsorbed ions, and (e) of all of these factors as they modify not only the mass of vegetation produced but also as they modify the ratios of carbohydrates to proteins, vitamins, etc., synthesized by the crop plants. Such changes in organic composition of the crop were shown to be manifestations of physiological differences, within the same plant species, caused by differences in the suites or combinations of the

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Fertilize by Test— Not by Guess!

By W. L. Garman

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HOW much and what kind of fertilizer will you recommend in '54? Compared to other things recommended to the farmer, fertilizer is one of the surest to return him extra dollars on his investment, that is, if good judgment and sound advice are used in planning his fertilizer program.

Of course, a first-hand knowledge of the climatic potential of the area, the general soil situation, and the level of management on the farm are important factors for consideration, but certainly soil tests can be extremely useful in taking part of the "guess work" out of fertilizer recommendations.

Several ways in which soil tests may be used to plan a fertilizer program are:

(1) To show whether a reserve of phosphorus is present or being accumulated in the soil as a result of past fertilizer practice.
(2) To determine the need for a high-potash fertilizer as either a starter or a topdress application.
(3) To measure the level of organic matter that is available for maintaining a good soil structure and for supplying nitrogen.
(4) To obtain an accurate measure

Fig. 1. Modern instruments, like this flame photometer used at the Cornell Soil Testing Laboratory, have greatly improved the reliability of soil tests. This instrument accurately determines the amounts of potassium and calcium that have been extracted from the soil.

of soil reaction as well as magnesium availability.

In most of the country, the principal use of the soil test is to help determine the ratio or grade of fertilizer that will most economically increase crop production. Thus, the soil test serves to indicate the relative availability or deficiency of plant nutrients.

Fertilizer Trends

With the exception of the arid regions where available moisture more frequently limits plant growth, soil scientists have found that few—if any—soils possess sufficient natural fertility to produce maximum yields by present-day standards. The consistent high yields that are obtained on thousands of crop and pasture land acres are no accident. Much of the increase can be credited to new varieties and hybrids; more of it to improved techniques of managing the crop and the soil. But still more can be credited to fertilizers that contain a higher percentage of nitrogen and potash.

One might conceivably refer to the present trend in fertilizer practice as the "Nitrogen Revolution" in crop production. The phenomenally high yields that are reported in so many sections of the country can be closely correlated with increased nitrogen utilization. This does not mean that phosphorus and potassium are not important. Actually, phosphorus has been most frequently the first limiting factor in crop production. And now as crop yields per acre increase, many more of our soils that cannot supply an adequate amount of potassium are being found. As an example, stalk rot in corn fertilized at high nitrogen levels appears to be more prevalent where high potassium levels are not maintained.

With the many recent advancements in crop production technology, the general trend in fertilizer recommendation is toward fewer grades and ratios. The result has been narrower ratios with proportionately larger amounts of nitrogen and potassium in the mixture.

Recommendations Based on Soil Tests

The following outlines show how soil test results may be used as a guide to help determine the fertilizer ratio or grade that may be used for a few different field crops.

FOR SOILS WHICH TEST LOW IN BOTH PHOSPHORUS (P) AND POTASSIUM (K)

In addition to P and K, most soils need extra nitrogen for small grains, corn, and the like.

Crop	Ratio	Possible grades
Small grain to be seeded with legumes	1–2–2	8–16–16 or 5–10–10
Small grain spring sown (not seeded)	1–1–1	10–10–10 or 12–12–12
Corn (not side-dressed)	1–1–1	10–10–10 or 12–12–12
Corn (to be N side-dressed)	1–2–2	8–16–16 or 5–10–10
Legume meadows or pastures	0–1–1	0–20–20

FOR SOILS WHICH TEST LOW IN P AND MEDIUM TO HIGH IN K

Crop	Ratio	Possible grades
Small grain (to be seeded with legumes)	1–2–1	12–24–12 or 6–12–6
Corn (not side-dressed)	1–1–1	10–10–10 or 12–12–12
Legume grass meadow or pasture	0–1–0	0–20–0

FOR SOILS WHICH TEST HIGH IN BOTH P AND K

Even though some soils test high in both P and K, the young seedlings of most field crops are stimulated by a "starter" fertilizer. There are several ways in which savings may be made

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The Place of Fertilizer in Community Improvement

By J. P. Carmichael

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THE newspaper headline caught my attention. At first glance it seemed odd:

MEETINGS SCHEDULED TO SHOW PLACE OF FERTILIZER IN COMMUNITY IMPROVEMENT

The story went on to say that leaders of the Georgia Plant Food Educational Society and the Agricultural Extension Service were holding a series of meetings to discuss the role of fertilizer in community development.

It did make sense. Better plant food means better crops and livestock. Better crops and more livestock mean increased income. Increased income brings about better living standards. Improved living standards create a desire for a better place in which to live. Better communities are the result.

Recently, I visited a number of prize-winning communities in organized community development areas to see first-hand some of the accomplishments of people who have banded together for common good. I found farm and community accomplishments galore. But I found more . . . people and a spirit of friendly harmony . . . people working together happy in their accomplishments . . . people planning together for even more outstanding work.

I found the better farming which the newspaper article forecast. In communities participating in the north Georgia area, I found that fertilizer usage had increased from 26,500 tons in 1952 to 36,500 tons in 1953. The amount of lime used had increased 44 per cent in the same period. The number of feet of terraces built increased a tremendous 400 per cent. Nearly 3,000 soil samples were taken and nearly 4,000 acres of idle land were reclaimed —both figures representing 37 per cent increases.

The community improvement program has given the people of Milford community in Cobb County a keener appreciation of the value of the land and their obligation to it. Most Milford people are employed in industries, do only part-time farming. But they have sown their land in legume cover crops to preserve its value for posterity.

In the area program, nearly 2,000 farmers produced 50 or more bushels of corn per acre, 2½ times the State average and a 279 per cent increase in number over 1952. The bales of cotton produced increased more than two-fold. Permanent pasture acreage increased 58 per cent and winter pasture increased 73 per cent. The number of dairy cattle raised went up from 8,200 to 17,500; beef cattle numbers increased from 11,700 to 23,400. The number of chickens raised (mostly broilers) jumped from seven to nearly twenty million!

Woods Grove community in mountainous Towns County, first-place winner in the Atlanta area program in 1953, shows that better practices bring better yields. When their rich bottom lands were covered by a lake in 1940, residents thought their farming future was ruined. Instead of leaving the community, they moved up on the hillsides, and today with better farming

practices, new crops and livestock, they are producing more than ever before. Last year 26 farmers, 4-H and FFA members, produced 100 bushels or more of corn per acre!

Community improvement promotes sound systems of farming. In the Minton community in Worth County (not in an organized area community development program), improved yields of tobacco and truck crops are evident. More than 90 per cent of the corn is hybrid and yields have doubled. Reforestation has been stimulated and at least 1,000 acres of Coastal Bermuda have been planted. Wildlife is being promoted with feed and cover crops and farm ponds have become numerous.

Along with these increases in production came machinery to make the task easier and more efficient. Nearly 1,400 farmers in the Atlanta area program had trucks in 1953, nearly 700 had tractors, 500 mowing machines, 100 combines, 129 hay balers, 51 corn pickers and 600 milking machines.

Better farming brought a better food supply. The families canned nearly 1,100,000 quarts of foodstuff, a 56 per cent increase. They froze 500,000 pounds of food, a 260 per cent increase. Nearly 700 families added home freezers. All told, they consumed more than $2,000,000 worth of home-produced foodstuff.

In the Liberty community, Dawson County, third-place prize winner, 97 per cent of the families have home gardens and they canned 17,892 quarts of food and froze 4,890 pounds during the year. Home-produced food was valued at $25,000.

Better farming brought better homes. Nearly 7,000 homes had running water, an increase of 135 per cent. More than 5,000 had bathrooms with 3,500 being added during the year. Four thousand had telephones, a 3,000 increase. The number of electric water heaters, refrigerators, washing machines, radios and television sets purchased showed a substantial increase with $1,600,000 being spent on home equipment. New buildings and repairs to existing farms and homes amounted to $5,000,000.

Better farming and better homes brought better communities. Nearly 26,000 people were taking part in church activities, a 60 per cent increase. Nearly 22,000 were taking part in community improvement programs, an increase of 170 per cent. The number of persons voting showed a 31 per cent increase and the number taking part in community health programs increased 65 per cent. The people spent $520,000 improving their churches and $55,000 improving or building community centers. Labor and materials for other phases of community beautification were valued at $167,000.

The spirit of community improvement is contagious. Boardtown community in Gilmer County, second-place Atlanta area winner, doubled the number taking part in community activities. They developed such an attractive program of improvement that 23 families on the edge of the community asked to be made a part of Boardtown so they could share in the work and fun and progress.

"The community improvement program has meant more to us than anything else except our homes and churches," says Trammell Carmichael, president of the Avery community organization. "This organization has been the backbone of our progress—religious, social, and financial."

Community improvement programs can help keep them down on the farm. When the Crowell school, Taylor County (in the Chattahoochee Valley area program), was consolidated with one away from the community, the building reverted to the community and was made into a community center. With a good meeting place and an active, attractive program, the children of Crowell stay home nights and weekends. Other young people of the county meet with them, and the center in this rural community has become the focal point for many youth activities in the County.

Fig. 1. Atomic cloud seen from Hiko plots where forage grasses and legumes are being tested.

Research in the Desert

By John M. Fenley

Clark County Agent, Las Vegas, Nevada

RESEARCH, both atomic and of the grassroots, is conducted in the Nevada desert. Within sight of radioactive clouds from atom bombs set off at Frenchman Flat, north of Las Vegas, are 34 experimental forage grasses and 12 alfalfa strains, planted at Hiko, Nevada, by the Experiment Station and Extension Service of Nevada.

Fifty airline miles are between the two experimental areas. Rarely has this short distance separated two more divergent types of research. One form of experimental endeavor uses the wide expanse of desert waste to measure the tremendous powers of destruction from nuclear chain reaction blasts, and find ways to harness released force for tactical advantage. The other research is to determine the power of feed production range and pasture soils have in terms of hay and beef produced when adapted species are properly planted and managed.

Both the atom tests and the forage tests are something new under the desert sun. Less than two years old, each may have profound influence to exert. Tomorrow—Atomic energy for the world; today—Practical down-to-earth improvement of agricultural living.

SOIL FERTILITY

(Basis for High Crop Production)

By George E. Smith

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SOIL management practices have undergone radical changes in recent years. The possibilities for increasing farm efficiency through eliminating low soil fertility as a limiting factor in crop production are just now being appreciated. Recent research in the development of soil tests and the application of required nutrients will permit the production of high yields on poor soils in favorable seasons. Through these soil-building programs, much land abandoned because of erosion or excessive nutrient removal has been made more productive than when first cultivated. Other fields considered suitable only for trees or rough pasture are producing profitable yields of corn and other crops. The wide difference in the initial productiveness of many virgin soils has been almost eliminated in favorable seasons. People on many soils of low fertility need no longer be held down to a standard of living based on nutrient delivery by low-producing fields. They can now enjoy the same advantages as their neighbors who possess better land. These findings on methods of restoration of soils of low fertility, or those seriously depleted, may rank among the most significant in agricultural research.

Emphasis on Organic Matter

Our past agricultural production has been closely associated with the quantity of organic matter in soils. Probably over 95% of the nitrogen and over 50% of the phosphorus absorbed by crops on unfertilized soil come from organic matter. With soils high in humus and conditions ideal for organic matter breakdown, yields are usually high. But in excessively dry or wet seasons, these nutrients are not released and yields are reduced. Crop rotations including legumes have been widely used as a means of restoring soil nitrogen and organic matter. The value of these legumes has been almost universally accepted, yet under practical farm conditions, instead of greatly improving soil fertility, they have added only limited amounts of nitrogen and masked fertility decline. Legumes add nitrogen and furnish soil cover, but remove more minerals from the soil than do grain crops, particularly when only the grain is removed. The high mineral and nitrogen contents of legumes account for their value as livestock feed.

On Sanborn Field at the Missouri Agricultural Experiment Station, 65 years of different cropping systems show soil changes resulting from different crop sequences and soil treatments. Where legumes and grasses have been included in crop rotations without soil treatments, the soil now contains less phosphorus, potassium, calcium, and magnesium than where corn or wheat has been grown continuously. The first cropping system that failed was continuous clover without soil treatment. After 15 years, this system was abandoned—not because of accumulation of insects or diseases—but the removal of this crop for hay removed minerals to such an extent that clover would no longer grow.

Legumes are grown as green manure crops for soil improvement. However, where livestock are produced, the use of legumes primarily for soil improve-

ment is more an ideal than a practice. Most legumes will be used as livestock feed. It is reasoned that where manure is returned, the soil is benefited. However, except in those regions where winters are so severe as to require barn feeding, the efficiency of manure returns is too low to be of much value. In much of the southern two thirds of the United States, most winter feeding is done in pastures and there is little manure to be returned to cultivated fields.

Experiments show that legumes will not furnish sufficient nitrogen for optimum corn yields. The addition of chemical nitrogen when legumes are turned under has given profitable increases in yield.

TABLE I.—YIELD OF CORN FOLLOWING LEGUMES WITH AND WITHOUT SUPPLEMENTAL NITROGEN.* 3-YEAR AVERAGE—PUTNAM SILT LOAM

Corn following	Yield-bu.	
	No N.	66 lbs. N.
Red clover	74	101
Sweet clover	90	110
Lespedeza	83	96
Soybeans	82	110
Timothy	74	95

* Mineral treatments added in quantities to remove them as limiting factors in production.

Since chemical nitrogen is being used in ever-increasing quantity, the need for additional minerals to maintain a proper balance is a necessity for maximum yields of quality crops.

Soil Tests Show Nutrient Needs

As soils declined in fertility, small additions of phosphates and then mixed fertilizers were applied to improve yields. For years both experiments and farm practice attempted to determine the minimum quantities of applied nutrients that would give a profitable response. In few cases was the quantity of nutrients added sufficient to replace that removed in crops. Consequently soil fertility continued to decline.

It formerly was possible to determine nutrients needed for a given soil type through field experiments. However, past management has changed soil nutrient levels to an extent that greater variations may be found on adjoining farms than between soils with widely different characteristics. Without soil tests it is not possible to determine the limiting factors in plant growth. Addition of plant nutrients in fertilizers to bring a low fertility soil up to highly fertile soil that will produce top yields may in some cases involve a cost nearly equal to the value of the land. In the interest of farm efficiency and best plant growth (proper balance of nutrients is important), only those nutrients that are deficient should be added. Experiments have shown that the addition of a nutrient already present in adequate amounts may depress rather than benefit crop yields and quality.

Early use of soil tests to determine the kind of starter fertilizer to apply was frequently unsatisfactory. It is extremely difficult to conduct field experiments and show much difference in crop responses between two fertilizer ratios, such as 3-12-12 and 4-12-8. In most cases the quantity of nutrients applied is not sufficient for high yields. Seasonal variations in climate will frequently exert more influence than will the difference in these two formulas. Many early tests were developed for sandy soils along the East Coast and the South, and were not adapted to Midwest soils. Not until tests adapted to this Midwest area were developed and used as a measure of nutrient reserves to correlate with field response did they give satisfactory correlation with soil treatments and increase in use.

Interpreting Soil Test Results

Organic matter is about 5% nitrogen. Under Missouri conditions, and the soil tests in use, from 4 to 6% of this nitrogen will be released on sandy soils (depending on climatic conditions). Silt loams will release from 2 to 3%, and

loams and clay loams about 1¼ to 2½%. If a soil analysis shows 2% organic matter, then the surface 7 inches (2 million pounds) would contain 40,000 pounds. Considering a content of 5% nitrogen, this soil would contain 2,000 pounds of nitrogen, or 1,000 pounds for each 1% organic matter. If the soil was a silt loam and from 2 to 3% of the nitrogen were released annually, then this surface soil could provide a corn crop with from 40 to 60 pounds of nitrogen, or sufficient for yields of 30 to 40 bushels per acre.

These methods of calculations have given good correlations with field experiments. The high levels of release are obtained in good seasons and the low levels in excessively wet or dry years. A summary of 208 fertilizer experiments with corn conducted in all parts of the State showed that nitrogen applied according to soil tests, (ample minerals present) which included an average of 80 pounds of nitrogen per acre, increased yields from 56.9 to 97.3 bushels. This was an increase in yield of 1 bushel for each 2.2 pounds of nitrogen added.

Small grains make most of their growth during the cooler season of the year when organic matter breakdown is slower. Satisfactory correlations have been obtained using values for release of nitrogen from the soil equal to one half that used for corn.

Phosphorus becomes a limiting element when levels of available nitrogen are increased. Our field results indicate that for maximum yields of wheat and clover the silt should show a reserve of near 200 pounds of phosphorus per acre, and for corn, soybeans, and oats at least 100 pounds.

Potash needs are increasing as we remove more legumes. Best results with corn and clover have been obtained with tests showing potassium levels of near 300 pounds per acre. A 200-pound level appears adequate for soybeans, wheat, and oats. Recent experimental work suggests it may not be desirable to add quantities of potassium much greater than these, except on soils of high clay content.

Limestone is generally used throughout the State. There are indications that soil tests may be of more value in determining when a soil contains sufficient lime than in determining the amount to apply. Recent tests show that some soils have been overlimed, creating potassium and boron deficiencies. Where high calcium liming materials have been used, magnesium is becoming a limiting element. Dolomitic limestone is not effective if soils are near neutrality, and soluble magnesium compounds must be applied to correct deficiencies. Soil tests for determining the liming status of the soil are probably the most dependable of all in use.

Adequate Nutrients Reduce Seasonal Hazards

Although interest in adequate fertilization is at the highest pitch in history, there has persisted the dread of losing both crop and fertilizer in unfavorable seasons. In 1951 some areas of the State experienced the heaviest rainfall on record. Where adequate nitrogen was plowed down and minerals had been provided, the corn outgrew grass and weeds. The added nitrogen, substituted for that normally provided by organic matter, nourished the plants, and yields were well above average.

The seasons of 1952 and 1953 were extremely dry. The favorable response in these years has dispelled the fear of losses in dry seasons and promoted the use of soil testing and the application of treatments to provide adequate nutrient reserves. For example, where moisture was too short to produce corn grain, adequate nutrients in many cases made the difference of whether there were silage and forages for winter feed, or whether a dispersal of herds for lack of feed was necessitated.

In a corn experiment at Columbia in 1952, where only 2½ inches of rain fell from July 3 to August 8 and the average maximum temperature was 91

TABLE II.—ADEQUATE SOIL FERTILITY PERMITS THICKER PLANTING AND HIGHER YIELDS IN DRY SEASONS. (COLUMBIA, 1951-52)

Nitrogen applied	Plants per acre	Acre yield in 1951	Acre yield in 1952
		bu.	bu.
None	8,000	81.1	53.6–Highest
	11,000	84.7	45.1
	14,000	91.4	39.5
	17,000	80.6	32.7
50 lbs...	8,000	75.1	60.7
	11,000	76.6	61.6–Highest
	14,000	87.5	48.5
	17,000	86.1	42.5
120 lbs...	8,000	95.7	79.9
	11,000	106.7	84.1
	14,000	123.4	86.2–Highest
	17,000	122.2	78.0
250 lbs...	8,000	96.8	85.5
	11,000	109.8	95.9
	14,000	122.8	93.5
	17,000	129.6	97.1–Highest

degrees, adequate fertility made the difference between profit and loss. Where no nitrogen was used, the highest corn yield was 54 bushels (only 60 per cent as much as in 1951), and this was obtained with a thin stand. Where the population was increased, yields declined. Where 50 pounds of nitrogen were plowed down, the highest yield (61.6 bushels) was secured with a population of 11,000 plants. With thicker planting, the yields again went down. The addition of 120 pounds of nitrogen gave the highest yield, i.e., 86.2 bushels, at 14,000 plants. But where 250 pounds of nitrogen were used, the high yield was 97.1 bushels from a stand of 17,000 plants per acre. Under these conditions of short rainfall it is seen that the heavier rates of planting decreased yields only where there was a shortage of nitrogen, It might also be concluded that providing plenty of plant food made a limited supply of moisture more effective.

Continuous Corn With Full Soil Treatment

There is now much interest in the production of continuous corn. Recent evidence indicates that when properly fertilized and managed, corn may be grown continuously with high yields and less erosion than under systems that have been followed in the past. The corn crop is not erosive, but lack of knowledge regarding soil fertility requirements and other management practices has led to this general belief.

In one experiment at Columbia where corn has been grown continuously for the past six years, yield fluctuations have been greatly reduced. With no nitrogen, yields have varied from a high of 79 bushels in 1949 to a low of 23 bushels in 1951—a variation of 56 bushels per acre. However, where 150 pounds of nitrogen were applied with adequate minerals and a population of 16,000 plants provided, yields have varied from 109 bushels in 1950 to 81 bushels in 1952—a variation of only 26 bushels.

TABLE III.—EFFECT OF SOIL DEPTH AND FERTILIZER TREATMENT ON CROP YIELD (3-YEAR AVERAGE, BU./A)

Soil depth	Soil treatment	Corn	Wheat
Double...	Lime+starter	86.3	17.5
Normal...	Lime+starter	71.8	16.0
Subsoil...	Lime+starter	52.1	8.1
Subsoil...	Full treatment	86.7	27.3

Protein and Shelling Percentage of Corn Influenced by Soil Treatment

The addition of nitrogen can increase both the per cent and acre harvest of crude protein in corn grain and stover. As more nitrogen was added (Table IV), the crude protein was significantly increased from 7.2 to 9.6% in 1951 and 7.1 to 10.2% in 1952. It is of interest that where 50 pounds of nitrogen were supplied, the crude protein was slightly lower in both years than where none was added. It is suggested that at the

50-pound level more low nitrogen organic matter was added than where no treatment was applied.

TABLE IV.—PER CENT CRUDE PROTEIN IN SHELLED CORN

Nitrogen applied	1951	1952
None	7.78	7.28
50 lbs.	7.25	7.12
120 lbs.	8.83	9.19
250 lbs.	9.64	10.27
LSD 1%	.30	.19
5%	.23	.13

Soil treatments have influenced shelling percentage. In 1953 experiments where soil treatments have been inadequate and yields have been from 20 to 30 bushels per acre, the shelling percentage has been about 75%. But where full treatment was applied, the shelling percentage has been average—80%. This means that a 7,000-pound load of the fertilized corn would give 5,600 pounds of shelled corn, or 100 bushels. However, a 7,000-pound load of the untreated ear corn would shell only 5,250 pounds, or only 93.7 bushels.

Wheat Responds to Full Soil Treatment

Similar results have been obtained with wheat. In 1953, yields were increased from less than 15 bushels per acre to over 40 bushels by following soil tests. Results have been particularly striking when the added fertility produces more vigorous plants and reduces winter injury (starvation). When conditions are unfavorable for nitrification, the effect of added nitrogen has been most spectacular.

Pastures Can Be Improved With Nitrogen

No land is so extensive or so in need of improvement as are permanent pastures. Much of this land was initially low in fertility, or has been exhausted through cultivation, and is now producing a low yield of poor quality forage. In both experiments and under practical farm conditions, the addition of adequate nitrogen with other plant nutrients has increased hay yields from less than a ton to over six tons per acre. In most states, demonstrations can be found where meat production has been increased from less than 100 pounds per acre to over 500 pounds. Similar increases are obtained in milk production. Attempts have been made to maintain combinations of grasses and legumes in these mixtures. Difficulty in maintaining proper balance of these plants has focused attention on applying chemical nitrogen to the grass (with adequate minerals) to obtain maximum yield of high protein forage. The nutrients that need be added can be determined by soil tests.

Residual Effects of Fertilizers

In the past, the entire cost of soil treatment has been charged to the crop treated. With heavier treatments, residual effects are striking. In experiments where nitrogen at rates of 200 pounds has been applied to corn, the yield of the following wheat crop has been sufficient to pay for the entire nitrogen application with none being charged to the corn. In seasons favorable for the growth of oats, similar residual responses have been secured

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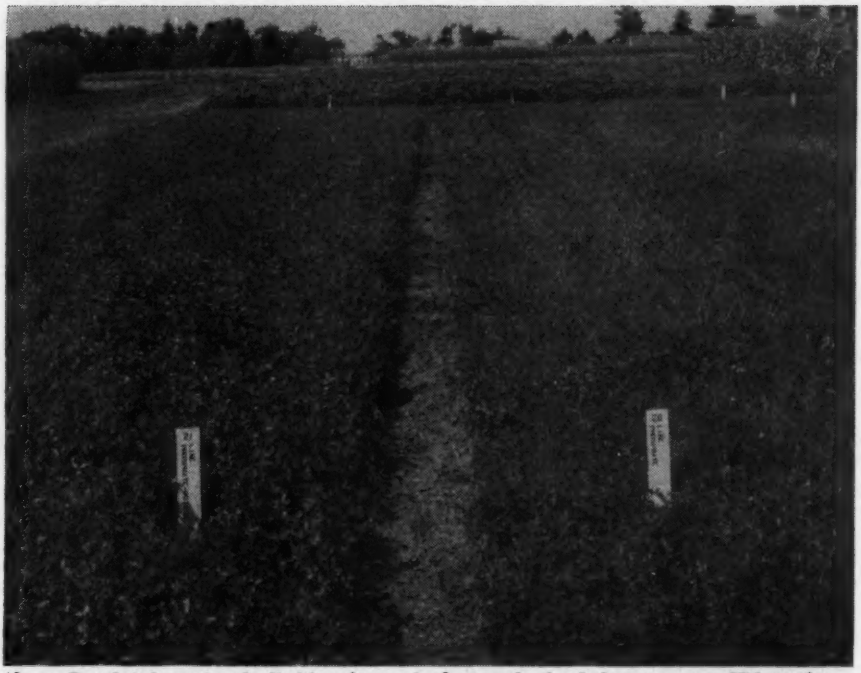
TABLE V.—RATE OF APPLICATION AND RESIDUAL EFFECT OF NITROGEN

Nitrogen applied	Yields per acre	
	Corn 2 yr. av.	Wheat 1 yr. av.
0	86.2 bu.	15.7 bu.
33	95.7	18.0
66	102.5	19.0
132	114.5	22.7
200	116.7	28.0

Soil limed to pH 6.2,2000# rock phosphate, 3-12-12 at 150# on corn and 300# on wheat.



Above: Potash is becoming the limiting element in the growth of red clover on many Midwest farms. Increased use of other nutrients and crop removal (right) have reduced the level of potassium on many soils where formerly there were adequate supplies of this element.

Below: Much land considered too poor for crops can be made productive if the proper nutrients are provided. Right: Fescue and ladino with adequate soil treatment.

Above: Cotton has a high potash requirement. The cotton on the left received full soil treatment and produced over a bale of lint per acre. That on the right was deficient in potash and yielded only 120 pounds lint cotton—not enough to pay the cost of production.

Below: Corn producing over 100 bushels per acre will return over three tons of organic matter. Special cutters are required to chop stalks.

Above: Wheat has a high nutrient requirement. The wheat with no treatment (center) produced less than 10 bushels per acre. That on the right which received 3-12-12 as a starter fertilizer and nitrogen as a topdressing yielded over 40 bushels per acre.

Below: Corn is not an erosive crop when it is adequately fertilized and the stalks are returned to give a protective cover.

Above: The corn on the left, with treatments according to soil test, produced over 75 bushels per acre in central Missouri during the dry season of 1953. Where potash was low (right), the yield was only 34 bushels.

Below: This field was treated according to soil test recommendations, and the stand increased to better utilize the added fertility.

The Editors Talk

Our Cover Picture

The upper portion of our cover illustration this month is a view of lush-growing peanuts against a background of good corn. The lower portion shows (left) a healthy peanut leaf, (right) symptoms of potash starvation. These symptoms can be described as necrotic areas around the margins of the leaf which may merge to produce a scorched effect. In the late stages of potash deficiency, the stems near the tips of branches become reddish in color, then brown. Death of the tissue follows.

Although the peanut, like other legume crops, is a heavy feeder on potash, potash-deficiency symptoms on the plant are not commonly observed in the field. However, long before a symptom appears on a leaf, the plant may be suffering from potash deficiency to a degree which will seriously reduce yield and quality.

Something of an enigma as to its use of fertilizer, the peanut has been called the "unpredictable legume." Its origin still has not been definitely determined. Supposedly introduced to North America via slave ships from Africa, the plant has been known to Europeans since the sixteenth century, and there are many references to it in early South American literature.

Importance of the crop began to grow with the importing and crushing of peanuts for oil in France about 100 years ago. Increased need for oil during wartimes has taken the "ground nuts" out of use for hog feed into recognition as one of the commercially important crop plants of the world both for its oil and edible stocks.

Dr. E. T. York, Jr., Agronomist of the North Carolina State College well-informed in the growing of peanuts says:

"Few crops can compete with peanuts for the reputation for peculiarity and uniqueness. The peculiarity begins with the name itself. The peanut or 'ground nut,' as it is sometimes called, is, in a true sense, not a nut but rather a pea. Its reputation for uniqueness is heightened by the fact that it is the only domestic plant whose flowers are produced above ground while its fruit develop beneath the surface of the soil.

"The unpredictable behavior of peanuts to fertilization is legendary among agronomists who have experimented with this crop. Perhaps the most significant factor contributing to its reputation for peculiarity is the fact that the peanut has successfully 'resisted' attempts at increased production, and the average yields in the United States are essentially no higher today then several decades ago. This, of course, is in marked contrast to the progress that has been made in increasing yields of other common field crops. In recent years, however, intensive research programs have helped to unravel many of the mysteries associated with the production of this crop. This work has indicated many reasons why peanuts behave as they do and it should serve as the basis for marked increases in production in the future."

For some of the latest findings of research on this crop, see the article "Peanut Production Trends in North Carolina" by Astor Perry beginning on page 6 of this issue.

Cooperation in Research

In one of his numerous public addresses last year, Secretary of Agriculture Ezra Taft Benson, while calling for more cooperation between industry and government in research in agriculture, paid tribute to what has been and is being done. Pointing out that although undoubtedly the Department of Agriculture lacks adequate information on what industry is doing and industry lacks enough information on what the Department is doing, cooperation between the two is good.

For examples he cited that in 10 years' time, industry and agriculture, working together, have put hybrid corn on farms. In 10 years, working together, industry and agriculture have doubled the use of fertilizer. In 15 years, they have largely accomplished the miracle of farm mechanization. In the past 50 years, the overall efficiency of our farm production has been doubled—largely through research.

The Secretary went on to point out that in 1850 each farmer produced enough for himself and four others. Today he produces enough for himself and 14 others. Moveover, agricultural research has constantly fed new ideas to industry for adaptation and development and it has given impetus to our growing knowledge of human nutrition and health.

"But if agricultural research has contributed greatly to industry and to the national welfare," he said, "so also has industrial research contributed immensely to agriculture. Industry, in fact, ranks first in agricultural research.

"Perhaps this comes as a surprise to many who assume that tax money is used for most research. Yet estimates indicate that industry spends $140 million a year for research on agricultural products and on machinery and materials used in agriculture. Public expenditures for agricultural research, both State and Federal, total $107 million."

The Secretary paid tribute to industry for these tremendous investments in research which have helped make our farmers and agriculture generally the most efficient and prosperous in the world. With a continued and increased cooperation between industry and government in research, he sees the opportunity to make the record of the future twice as good as the record of the past.

Such a goal certainly is something for everyone connected with agriculture to work for—and that includes every American. With agriculture our basic industry, each and everyone of us has a stake in its prosperity. We may not all, in fact very few of us will, be even remotely connected with agricultural research projects, yet interest in them and in the dissemination of information concerning results obtained is in degree often as important as the project itself. And everyone can and should be interested.

"Generally speaking, the American farmer has about kept pace with his city cousin when it comes to increased efficiency. The result is that he has the highest living standard of all farmers in the world today. . . . The American farmer must continue to increase his efficiency if he is to continue to improve his standard of living."—*John H. Davis, Ass't Secretary of Agriculture.*

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb. Aug.-July	Tobacco Cents per lb.	Potatoes Cents per bu. July-June	Sweet Potatoes Cents per bu. July-June	Corn Cents per bu. Oct.-Sept.	Wheat Cents per bu. July-June	Hay [1] Dollars per ton July-June	Cottonseed Dollars per ton July-June	Truck Crops ....
Av. Aug. 1909–July 1914....	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1928.....	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929.....	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930.....	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931.....	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932.....	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933.....	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934.....	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935.....	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936.....	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937.....	8.4	20.4	52.9	78.0	51.8	96.2	8.74	19.51	....
1938.....	8.6	19.6	55.7	69.8	48.6	56.2	6.78	21.79	....
1939.....	9.1	15.4	69.7	73.4	56.8	69.1	7.94	21.17	....
1940.....	9.9	16.0	54.1	85.4	61.8	68.2	7.59	21.73	....
1941.....	17.0	26.4	80.8	92.2	75.1	94.4	9.70	47.65	....
1942.....	19.0	36.9	117.0	118.0	91.7	110.0	10.80	45.61	....
1943.....	19.9	40.5	131.0	206.0	112.0	136.0	14.80	52.10	....
1944.....	20.7	42.0	150.0	190.0	109.0	141.0	16.50	52.70	....
1945.....	22.5	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946.....	32.6	38.2	124.0	218.0	156.0	191.0	16.70	72.00	....
1947.....	31.9	38.0	162.0	217.0	216.0	229.0	17.60	85.90	....
1948.....	30.4	48.2	155.0	222.0	129.0	200.0	18.45	67.20	....
1949.....	28.6	45.9	128.0	214.0	124.0	188.0	16.50	43.40	....
1950.....	40.1	51.7	91.7	173.0	153.0	200.0	16.70	86.50	....
1951.....	37.9	51.1	163.0	304.0	166.0	211.0	19.50	69.30	....
1952.....	36.9	50.0	196.0	331.0	157.0	209.0	21.05	70.00	....
1953									
March.....	31.52	....	165.0	401.0	146.0	210.0	19.65	63.60	....
April.....	31.45	....	134.0	409.0	146.0	208.0	18.85	63.10	....
May.....	31.73	51.5	115.0	413.0	149.0	206.0	17.95	61.80	....
June.....	31.51	51.0	102.0	398.0	146.9	188.0	16.05	61.20	....
July.....	31.87	51.2	95.5	402.0	147.0	187.0	15.45	59.00	....
August.....	32.77	51.3	91.4	350.0	148.0	186.0	15.85	56.70	....
September...	33.09	57.6	98.9	264.0	150.0	192.0	16.15	51.50	....
October.....	32.46	52.6	89.7	233.0	134.0	194.0	16.45	52.40	....
November...	31.82	42.3	83.4	232.0	133.0	200.0	17.25	53.40	....
December....	30.73	49.2	69.9	246.0	141.0	201.0	18.25	53.00	....
1954									
January.....	30.05	48.3	69.1	253.0	142.0	203.0	19.05	52.00	....
February.....	30.42	31.9	65.3	258.0	143.0	206.0	18.95	51.40	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1928.....	145	200	76	134	131	113	95	152	147
1929.....	135	183	189	133	124	117	92	137	137
1930.....	77	128	131	123	93	76	93	98	128
1931.....	46	82	66	83	50	44	73	40	107
1932.....	52	105	55	62	50	43	52	46	100
1933.....	82	130	118	79	81	84	68	57	90
1934.....	100	213	64	91	127	96	111	146	94
1935.....	90	184	85	80	102	94	63	135	116
1936.....	100	236	164	106	163	116	94	148	108
1937.....	68	204	76	89	81	109	74	87	114
1938.....	69	196	80	79	76	64	57	97	96
1939.....	73	154	100	84	88	78	67	94	98
1940.....	80	160	78	97	96	77	64	96	122
1941.....	137	264	116	105	117	107	82	211	138
1942.....	153	369	168	134	143	124	91	202	178
1943.....	160	405	188	235	174	154	125	231	270
1944.....	167	420	214	216	170	160	139	234	236
1945.....	181	366	205	232	198	170	127	227	240
1946.....	263	382	178	248	212	209	141	319	207
1947.....	257	380	232	248	336	259	148	381	262
1948.....	245	482	222	253	201	226	155	298	253
1949.....	231	459	184	244	193	213	139	192	232
1950.....	323	517	132	197	238	226	141	384	211
1951.....	306	512	233	346	259	239	164	307	269
1952.....	298	500	281	377	245	236	177	310	274
1953									
March.....	254	...	237	457	227	238	166	282	248
April.....	254	...	192	466	227	235	159	280	204
May.....	256	515	165	470	232	233	151	274	182
June.....	254	510	146	453	227	213	138	271	270
July.....	257	512	137	458	229	212	130	262	216
August.....	264	513	131	399	231	210	134	251	221
September...	267	576	142	301	234	217	136	228	159
October.....	262	526	129	265	209	219	139	232	175
November...	257	423	120	264	207	226	145	237	186
December....	248	492	100	280	220	227	154	235	224
1954									
January.....	242	483	99	288	221	230	160	231	271
February....	245	319	94	294	223	233	160	228	233

Wholesale Prices of Phosphates and Potash **

	Superphosphate, Baltimore, per unit	Florida land pebble, 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports [2]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports [2]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports [2]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947	.746	3.05	6.60	.432	.706	18.93	.195
1948	.764	4.27	6.60	.397	.681	14.14	.195
1949	.770	3.88	6.22	.397	.703	14.14	.195
1950	.763	3.83	5.47	.371	.716	14.33	.195
1951	.813	3.98	5.47	.401	.780	15.25	.200
1952	.849	3.98	5.47	.401	.793	15.25	.200
1953							
March	.860	4.22	5.47	.430	.827	16.00	.210
April	.860	4.28	....	.430	.827	16.00	.210
May	.860	4.28	....	.430	.827	16.00	.210
June	.860	4.28	....	.361	.708	13.44	.176
July	.895	4.28	....	.396	.768	14.72	.193
August	.895	....	.. .	.396	.768	14.72	.193
September	.895	....	....	.396	.768	14.72	.193
October	.895	....	....	.396	.768	14.72	.193
November	.895	....	....	.396	.768	14.72	.193
December	.895	....	....	.430	.827	16.00	.210
1954							
January	.895	....	....	.430	.827	16.00	.210
February	.895	....	....	.430	.827	16.00	.210
			Index Numbers (1910-14 = 100)				
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947	139	84	135	70	74	78	83
1948	143	118	135	67	72	58	83
1949	144	108	128	67	74	58	83
1950	142	106	112	68	75	59	83
1951	152	110	112	72	82	63	83
1952	158	110	112	72	83	63	83
1953							
March	160	117	112	76	87	66	85
April	160	119	...	76	87	66	85
May	160	119	...	76	87	66	85
June	160	119	...	66	74	56	80
July	167	119	...	71	81	61	82
August	167	...	...	71	81	61	82
September	167	...	...	71	81	61	82
October	167	...	...	71	81	61	82
November	167	...	...	71	81	61	82
December	167	...	...	76	87	66	85
1954							
January	167	...	...	76	87	66	85
February	167	...	...	76	87	66	85

Wholesale Prices of Ammoniates **

	Nitrate of soda bulk per unit N	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947	2.50	1.60	12.72	10.66	12.63	10.46
1948	2.86	2.03	12.94	10.59	10.84	9.85
1949	3.15	2.29	10.11	13.18	10.73	10.62
1950	3.00	1.95	11.01	11.70	10.21	9.36
1951	3.16	1.97	13.20	10.92	10.18	10.09
1952	3.34	2.09	13.95	11.27	9.72	9.16
1953						
March	3.34	2.28	12.69	11.24	7.16	6.56
April	3.34	2.28	11.75	11.24	6.07	6.00
May	3.34	2.28	10.34	11.24	6.23	6.14
June	3.34	2.28	10.61	11.26	6.62	6.31
July	3.34	2.28	10.34	11.15	6.75	6.14
August	3.34	2.28	10.14	10.95	7.53	6.68
September	3.09	2.28	9.82	11.04	7.51	6.91
October	3.09	2.25	9.73	11.24	7.96	7.75
November	3.09	2.22	9.61	11.24	8.19	8.19
December	3.09	2.22	10.96	11.24	8.50	9.03
1954						
January	3.09	2.22	11.28	11.24	9.26	9.71
February	3.09	2.22	11.20	11.45	9.34	10.02
	Index Numbers (1910-14 = 100)					
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	112	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947	93	56	363	302	374	297
1948	107	71	370	300	322	280
1949	117	80	289	373	318	302
1950	112	68	315	331	303	266
1951	118	69	377	310	302	287
1952	125	74	399	319	288	260
1953						
March	125	80	363	318	212	186
April	125	80	336	318	180	170
May	125	80	295	318	185	174
June	125	80	303	319	196	179
July	125	80	295	316	200	174
August	125	80	290	310	223	190
September	115	80	281	313	223	196
October	115	79	278	318	236	220
November	115	78	275	318	243	233
December	115	78	313	318	252	257
1954						
January	115	78	322	318	275	276
February	115	78	320	324	277	285

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and all Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1928.....	148	152	141	121	87	177	108	97
1929.....	148	150	139	114	79	146	114	97
1930.....	125	140	126	105	72	131	101	99
1931.....	87	119	107	83	62	83	90	99
1932.....	65	102	95	71	46	48	85	99
1933.....	70	104	96	70	45	71	81	95
1934.....	90	118	109	72	47	90	91	72
1935.....	109	123	117	70	45	97	92	63
1936.....	114	123	118	73	47	107	89	69
1937.....	122	130	126	81	50	129	95	75
1938.....	97	122	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	130	127	86	56	130	102	77
1942.....	159	149	144	93	57	161	112	77
1943.....	193	165	151	94	57	160	117	77
1944.....	197	174	152	96	57	174	120	76
1945.....	207	180	154	97	57	175	121	76
1946.....	236	197	177	107	62	240	125	75
1947.....	276	231	222	130	74	362	139	72
1948.....	287	250	241	134	89	314	143	70
1949.....	250	240	226	137	99	319	144	70
1950.....	258	246	232	132	89	314	142	72
1951.....	302	271	258	139	93	331	152	76
1952.....	288	273	251	144	98	333	158	76
1953								
March....	264	265	248	141	102	282	160	80
April.....	259	264	246	139	102	256	160	80
May.....	261	264	247	137	102	245	160	80
June.....	259	260	246	135	102	253	160	70
July.....	259	261	248	138	102	252	167	75
August....	258	262	249	139	102	261	167	75
September.	256	259	249	137	97	258	167	75
October...	250	258	248	137	96	265	167	75
November.	249	259	247	137	96	267	167	75
December..	254	260	248	141	96	285	167	80
1954								
January...	259	263	250	142	96	300	167	80
February..	258	264	248	142	96	301	167	80

* U. S. D. A. figures, revised January 1950. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning July 1949, baled hay prices reduced by $4.75 a ton to be comparable to loose hay prices previously quoted.

[2] All potash salts now quoted F.O.B. mines only; manure salts since June 1941, other carriers since June 1947.

**** Where range of prices for fertilizer material is quoted, average figure is used. The weighted average of prices actually paid for potash is lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. The maximum discount is now 16%. Applied to muriate of potash, a price slightly above $.353 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Analyses of Official Fertilizer Samples, Semi-Annual Report, January-June, 1953," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Regulatory Bul. 109, Nov. 1953.

"Fertilizer Experiments with Corn in Central and Eastern Nebraska, 1953," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir. 35, Jan. 1954, G. W. Lowrey and P. L. Ehlers.

"Fertilizer Experiments on Native Subirrigated Meadows in Nebraska, 1953," Agr. Exp. Sta., Univ. of Nebr., Lincoln, Nebr., Outstate Testing Cir. 36, Jan. 1954, E. M. Brouse, P. L. Ehlers, and G. Viehmeyer.

"North Carolina Fertilizer Report for 1952-1953," N. C. Dept. of Agr., Raleigh, N. C., Bul. 133, Nov. 1953.

"Cotton Fertilizer Trials, High Plains of Texas, 1952," Agr. Exp. Sta., Texas A&M College, College Station, Texas, Prog. Rpt. 1637, Jan. 14, 1954, J. Box and D. L. Jones.

"Grain Sorghum Fertilizer Trials, High Plains of Texas, 1952," Agr. Exp. Sta., Texas A&M College, College Station, Texas, Prog. Rpt. 1638, Jan. 14, 1954, J. Box and D. L. Jones.

"Response of Coastal Bermuda Grass to Fertilizers," Agr. Exp. Sta., Texas A&M College, College Station, Texas, Prog. Rpt. 1639, Jan. 14, 1954, H. W. Gausman and W. R. Cowley.

"1954 Vermont Recommendations for Lime, Seed, and Fertilizer." Univ. of Vt., Agronomy Dept., Burlington, Vt.

Soils

"Soil Management," Agr. Ext. Serv., Univ. of Ariz., Tucson, Ariz., Cir. 211, Sept. 1953, H. E. Ray.

"Soil Survey of Southwestern New Brunswick," Canada Dept. of Agr., Fredericton, N. B., R. E. Wicklund and K. K. Langmaid.

"Irrigation Waters of Nevada," Agr. Exp. Sta., Univ. of Nev., Reno, Nev., Bul. 187, June 1953, M. R. Miller, G. Hardman, and H. G. Mason.

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"Agricultural Conservation Program Handbook for 1954 for: New Mexico, N. Dak.," U. S. D. A., Wash., D. C.

"Guide for Preparation of the Farm Conservation Plan," S.C.S., U. S. D. A., Wash., D. C., R-1 #290.

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"Furrow Irrigation," S.C.S., U. S. D. A., Wash., D. C., Lflt. 344, Dec. 1953, G. A. Lawrence.

"Soil Survey, Sullivan County, Tennessee," S.C.S., U. S. D. A., Wash., D. C., Series 1944, No. 2, Sept. 1953, B. L. Matzek, W. E. Cartwright, L. G. Yearick, F. R. Austin, C. B. Beadles, and S. R. Bacon.

Crops

"Studies with Pickling Cucumbers in Alabama," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala., Cir. 114, Sept. 1953, L. M. Ware, C. L. Isbell, H. Harris, and W. A. Johnson.

"Factors Affecting Pecan Yields, Recommendations for Increasing Nut Production," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala., Cir. 115, Sept. 1953, T. B. Hagler, W. A. Johnson, and H. G. Barwood.

"Annual Report of the Director of Science Service for the Year Ended March 31, 1953," Canada Dept. of Agr., Ottawa, Ontario, 1953.

"Growing Corn in Connecticut," Agr. Ext. Serv., Univ. of Conn., Storrs, Conn., Fldr. 67, Apr. 1953, R. I. Munsell.

"Manalucie, a Tomato with Distinctive New Features," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-59, Aug. 1953, J. M. Walter and D. G. A. Kelbert.

"The Lake Emerald Grape," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Cir. S-68, Jan. 1954, L. H. Stover.

"Establishing Bahia Grass From Seed," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper 83, Oct. 22, 1953.

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"Cooperative Wheat Variety Tests, 1953," Kansas Agr. Exp. Sta., Dept. of Agronomy, Manhattan, Kansas, Rpt. of Prog. Series C. E. No. 32, A. L. Clapp.

"Cooperative Oat Variety Tests, 1953," Kansas Agr. Exp. Sta., Dept. of Agronomy, Manhattan, Kansas, Rpt. of Prog. Series C. E. 33, A. L. Clapp.

"Pasture in Kentucky," Agr. Ext. Serv., Univ. of Ky., Lexington, Ky., Cir. 510.

"Growing Period of Leading Rice Varieties When Sown on Different Dates," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Bul. 476, June 1953, N. E. Jodon.

"Osseo Potato," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Misc. Rpt. 19, Jan. 1954, F. A. Krantz, C. J. Eide, C. H. Griffith, B. C. Beresford, O. C. Turnquist, M. Thompson, and A. G. Tolaas.

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"Cotton Report for the Blackland Experiment Station, 1952," Agr. Exp. Sta., Texas A&M College, College Station, Texas, Prog. Rpt. 1553, March 2, 1953, E. D. Cook, R. M. Smith, and D. O. Thompson.

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"El Paso Valley Cotton Variety Test, 1952," Agr. Exp. Sta., Texas A&M College, College Station, Texas, Prog. Rpt. 1608, Sept. 9, 1953, L. S. Stith and P. J. Lyerly.

"Summary of the 1953 Texas Corn Performance Tests," Agr. Exp. Sta., Texas A&M College, College Station, Texas, Prog. Rpt. 1633, Dec. 10, 1953, T. E. McAfee, J. S. Rogers, J. W. Collier, R. P. Bates, and J. M. Latham, Jr.

"Tomato Variety Tests in South-Central Texas, 1953," Agr. Exp. Sta., Texas A&M College, College Station, Texas, Prog. Rpt. 1635, Dec. 29, 1953, A. L. Harrison.

"Vegetable Gardening in Vermont," Agr. Ext. Serv., Univ. of Vt., Burlington, Vt., Cir. 109, Feb. 1954, C. H. Blasberg and R. Hopp.

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"Cost of Producing Apples in Orchard Areas of Washington in 1952," Agr. Exp. Sta., State College of Wash., Pullman, Wash., Sta. Cir. 228, Aug. 1953, G. D. Kile.

"The Demand and Price Structure for Oats, Barley, and Sorghum Grains," BAE, U. S. D. A., Wash., D. C., Tech. Bul. 1080, Sept. 1953, K. W. Meinken.

"Major Uses of Land in the United States," BAE, U. S. D. A., Wash., D. C., Tech. Bul. 1082, Oct. 1953, H. H. Wooten.

"Report of the Administrator of the commodity Exchange Authority, 1953," U. S. D. A., Wash., D. C., Oct. 20, 1953.

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"Farm Costs and Returns, 1952 (With Comparisons) 20 Types of Commercial Family-Operated Farms in 12 Major Farming Regions," BAE, U. S. D. A., Wash., D. C., Agr. Info. Bul. 116, Aug. 1953, W. D. Goodsell, J. Vermeer, W. H. Brown, H. C. Fowler, E. Hole, E. B. Hurd, and I. Jenkins.

"World Agricultural Situation 1954," Foreign Agr. Serv., U. S. D. A., Wash., D. C., Foreign Agr. Cir., Jan. 11, 1954.

Fertilize By Test . . .

(*From page* 18)

where soil test results show these high values. These are:

(1) To use narrower ratios such as 1-1-1, and these possibly supplemented or alternated with straight nitrogen materials;
(2) To reduce the total amount of fertilizer used.

The grades and ratios shown here are more generally typical of the situation in New York and other Northeastern States; however, the principles considered are the same in any area. Usually, the higher analysis grades are "better buys" in view of savings in freight which take up a high percentage of the fertilizer dollar.

The rate of fertilizer application is best determined by following "State Experiment Station" recommendations. These are firmly based on replicated trials of many long-time fertility experiments.

Fertilizer use can also be complicated by past treatment such as the application of manure, plow down legume and non-legume residues, and the like. Agricultural College specialists are available to offer assistance in handling these situations.

Soil tests offer an additional technique that will continue to be of much value for determining a fertilizer practice which will insure highest crop yields at least cost.

What kind of fertilizer will you recommend? Use soil tests to help get the right answer.

Fig. 2. Crop yields already have been reduced when these potash-deficiency symptoms appear. Soil tests backed up by proper fertilization would have increased yields and in some cases saved a good stand of alfalfa.

Soil Fertility . . .

(*From page 26*)

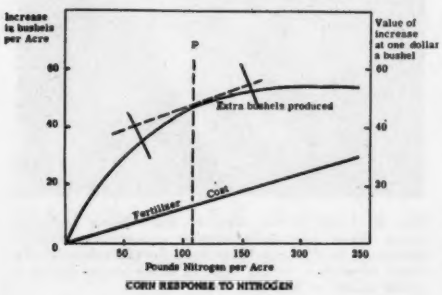
following corn when nutrient reserves have been restored according to soil tests.

Good Soil Samples Essential

Soil testing still requires some development and correlation with field experiments. Its value is attested by the number of tests being made in all parts of the country and the results that have been accomplished on farms. The weakest link in the soil testing program is poor samples. Laboratory methods are more accurate than field sampling. Too many samples are inadequate, or fail to be representative of the area to be tested. A poor sample can result in improper diagnosis of nutrient reserves and cause the use of improper treatment. For best results, a composite sample of at least six borings should be taken on each five acres (smaller area on high variable soils) and the average results from all samples of a field considered in determining the soil treatment program.

Efficiency Necessary

Farmers are now in a cost-price squeeze. They receive less for what they sell and must pay as much as ever for what is purchased. The optimum use of fertilizers will continue to be one of the most profitable farm practices. Without adequate plant nutrient additions, it may not be possible for many Missouri farms to produce crops at a profit if prices continue to decline. Fertilizers are applied by farmers to increase their earnings. Fertilizer use should be designed to return maximum profit to the user.



CORN RESPONSE TO NITROGEN

The upper solid line in the graph shows the additional increase in yield from nitrogen added to corn in over 300 Missouri experiments where ample minerals were applied. The lower line shows the cost of the fertilizer. The distance between these lines is profit. The greatest return per dollar spent is slightly over 100 pounds of nitrogen per acre (Point P). This type graph could be used to determine the fertilizer response of most crops on most soils.

Although the greatest return per dollar spent is at Point P, there is a wide range (from 60 lbs. of nitrogen to 140) where there is little difference in return. Applying too much fertilizer has about the same effect on profits as applying too little. Applying 50 pounds of nitrogen less than the most profitable rate would cut profits more than would the application of 50 pounds extra nitrogen. Applying 20 pounds too much or too little N would not appreciably affect profits. Cutting down on the fertilizer application with falling prices is "not playing it safe." The extra nitrogen applied will give residual effects on all but the most sandy soils in Missouri. The way to "play it safe" is to apply as nearly as possible the amount experimental data shows to be the most profitable.

Attention to All Crops

Most of our newer knowledge regarding the value of adequate fertility levels has been obtained on the corn crop. It appears that we can go little further

in improving yields by adding fertility until varieties with higher yielding potentials are developed. Experimental results indicate that the same improvement can be made in most crops. We should maintain the advances that have been made with corn, and strive to produce yields of soybeans, small grains, forages, and cotton comparable to 100 or more bushels of corn.

Fertility of Georgia Soils . . .

(*From page* 12)

contain intermediate amounts, and show a definite downward gradient as one proceeds from the coast to the mountains. Two factors are probably responsible for these differences. (1) There is less phosphorus fixation in the Coastal Plain soils than in those of the other areas. It is known that soils of sandy nature, such as those of the Coastal Plain, fix less phosphorus than finer (or heavier) textured soils such as those found in the Piedmont, Limestone Valley, and Mountain areas. (2) The rate of phosphate fertilization has been heavier in the Coastal Plain than in other areas of the State. (Figure 3).

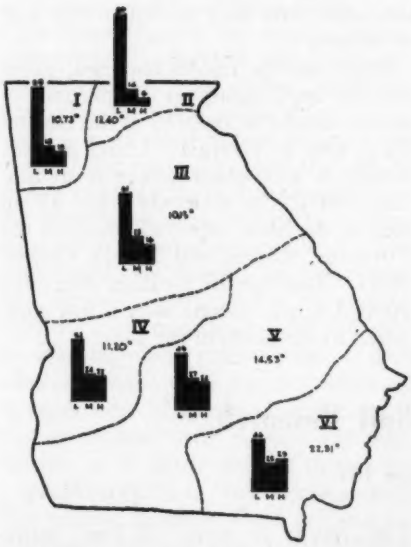


Fig. 3. Percentage of Georgia soils in various phosphate fertility groups 1945-51. Available lbs. P_2O_5 per acre. I. Limestone Valleys and Uplands; II. Mountains; III. Piedmont Plateau; IV. Upper Coastal Plain; V. Middle Coastal Plain; VI. Lower Coastal Plain. Phosphate (P_2O_5) levels—L. Low, 0 to 60 lbs.; M. Medium, 60 to 120 lbs.; H. High, Above 120 lbs. *Lbs. P_2O_5 applied per acre during 1945.

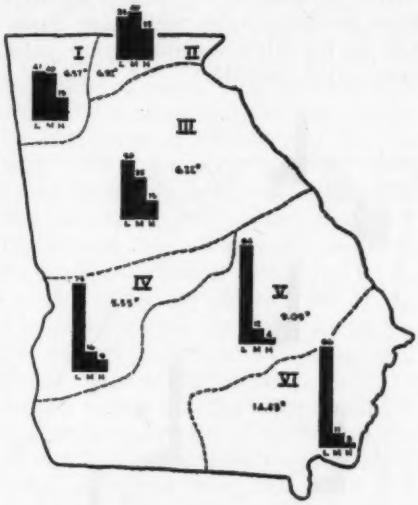


Fig. 4. Percentage of Georgia soils in various potash fertility groups. Available lbs. K_2O per acre 1945-51. I. Limestone Valleys and Uplands; II. Mountains; III. Piedmont Plateau; IV. Upper Coastal Plain; V. Middle Coastal Plain; VI. Lower Coastal Plain. Potash (K_2O) levels—L. Low, 0 to 125 lbs.; M. Medium, 125 to 225 lbs.; H. High, Above 225 lbs. *Lbs. K_2O applied per acre during 1945.

Potash

Potash, in contrast to phosphate, increases progressively from the Lower Coastal Plain to the Mountains. Available potash generally occurs in larger amounts in soils of heavier texture than in soils of lighter texture. Although large amounts of potash fertilizers have been used in the Coastal Plain, the available potash content of these soils has not been increased to any extent. Rapid leaching, which occurs in sandy soils, apparently prevents an increase in potash content.

Calcium

The available calcium level of Georgia soils is fairly low. The Limestone Valley and Uplands are better supplied with this element than soils of other areas in the State. The relatively high amount of available calcium in soils of the Limestone Valley and Upland area is a reflection of the parent material as well as the amount of limestone applied. Most of the samples which are classified in the high calcium group have been limed recently.

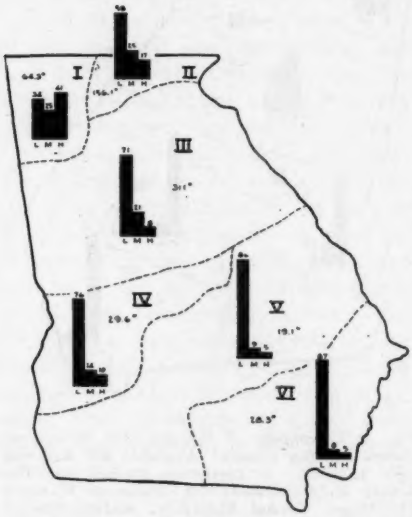


Fig. 5. Percentage of Georgia soils in various calcium fertility groups 1945-51. Available lbs. CaO per acre. I. Limestone Valleys and Uplands; II. Mountains; III. Piedmont Plateau; IV. Upper Coastal Plain; V. Middle Coastal Plain; VI Lower Coastal Plain. Calcium (CaO) levels—L. Low, 0 to 500 lbs.; M. Medium, 500 to 1,500 lbs.; H. High, Above 1,500 lbs. *Lbs. limestone applied annually per acre during the period 1941-48.

As can be seen in Figure 5, the amount of limestone applied per acre of cultivated land in Georgia is small.

Summary and Conclusions

Results of soil tests are used to group Georgia soils into different fertility levels. A greater percentage of soils have pH values within the medium acid range of 5.5 to 6.0 than any other range. Soils of the Limestone Valley and Upland areas have the highest pH values and also contain the greatest amounts of calcium. Coastal Plain and Piedmont soils contain less than 1.5% organic matter on an average, whereas the Limestone Valley and Mountain soils contain more than 1.5%. Available phosphorus is higher in the Coastal Plain, but the reverse is true of potash when compared with other areas in the State. Phosphate and potash fertilizer applications are heaviest in the Coastal Plain areas. The sandy soils of the Coastal Plain tend to fix less phosphorus than other soils of the State. At the same time they are inherently low in potash.

Based on the results obtained, phosphorus applications in proportion to potash should be reduced in the Coastal Plain area of Georgia. Using organic matter as a criterion, nitrogen applications should be relatively high on all soils of the State, especially those of the Piedmont, Upper and Middle Coastal Plain. The rate of fertilizer and lime applied to all Georgia soils is low compared to the needs of the soils.

Some Aims of Soil Research

(*From page* 16)

nutrient inorganic ions adsorbed on, and exchanged to the root from the clay colloid according to their respective activities there.

It was the aim of the research, using the colloidal clay technique, to study also the organic molecules in the soil. The results in terms of ionic movements by calcium, for example, into the plant roots were particularly different when a large organic one like methylene blue was adsorbed on the clay as the ion accompanying the calcium. This organic molecule eliminated

the differing degrees of calcium saturation as a factor in variable calcium uptake by the plant roots from a constant exchangeable amount in the soil. This was the first work demonstrating a different behavior by the exchangeable calcium on the clay when in company with a large organic molecule adsorbed there. Other phases of this concept, or theory, of the behaviors of the ions adsorbed on the clay varying, not according to the amounts exchangeable but according to the company they keep with other ions (nutrient or non-nutrient) and even when the exchangeable amounts are constant, have now become so ramified and numerous when treated by only chemical procedures, that they may become still more numerous when measured by crop creations of compounds representing nutritional values for animals.

It was another aim of the research, using the colloidal clay technique, to study the influence of the variable composition of the plant root on the movement into the root of different adsorbed ions from the suite of them on the clay. This demonstrated the much greater percentage of adsorbed and exchangeable potassium ions moved from the clay into the root when this was a legume in its physiological behavior because of bacterial inoculation than when it was physiologically a non-legume in the absence of these symbiotic microorganisms. It demonstrated also a much wider ratio of weights of plant tops to weights of roots under the former than the latter conditions. All this told us that legumes, representing a proteinaceous root with higher adsorbing energies than the non-legume roots with less of protein, will exhaust the soil-fertility to a much greater degree in a single crop than the non-legumes. The soils of Sanborn Field cropped to legumes in the rotation were depleted of their fertility much more rapidly than under rotations without legumes, the concept regarding legumes as soil-improvers notwithstanding. Naturally then the non-legumes can be grown on the same soil for many more crop successions than the legumes. Whether the plant is producing mainly carbohydrates or is converting much of these into proteins is significant in many aspects connecting themselves with the suite of ions going from the soil into the roots and thereby into the plant.

Such differences in movements of the ions from the exchange complex of the soil into the root when protein production by microbial addition to the soil was responsible, illustrates the impossibility of considering production of forage bulk as an index of what might be considered as efficiency of ions in their effects on plant growth. Soybeans as non-legumes produced more hay per unit of exchangeable potassium taken from the soil than the soybeans as legumes. When potassium is accompanied by the chloride ion in tobacco fertilization, the yields are higher per unit of potassium than when used in the form of the sulfate. Shall we see the sulfate effective in producing a higher concentration of protein in the tobacco leaf and thereby respiring more carbohydrates to bring this about and prohibiting the high bulk of carbohydrates accumulated as yield? Shall some research aim to study tobacco for its possibly increased sulfur-containing amino acid content, namely, methionine, when potassium sulfate is the fertilizer rather than potassium chloride? Differences in the synthesis of the protein for these fertility reasons may well be casually connected with the differences in the quality of the tobacco recognized in connection with these two kinds of potassium fertilizers on tobacco.

Wide differences in the amount of plant bulk resulting from a single unit of nitrogen illustrate well how widely what we might erroneously call efficiency of a nutrient element may vary according to the plant's synthetic performances used in measuring that efficiency. According as the plant produces more carbohydrate and more bulk, the efficiency of nitrogen as nu-

trient would be considered to go higher. According to the theory of Willcox, the maximum amount of nitrogen to be taken from an acre of soil should give over six tons of dry matter per acre in soybean forage; over thirteen tons per acre in corn; and almost fifty-six tons per acre in sugar cane, all of these from 318 pounds of nitrogen, or ten baules of this element. It should be the aim of research to clarify the concepts of the services by nutrients coming from the soil, if yields of bulk of such wide ranges from the same application of nitrogen are possible.

Mineral Reserves in the Silt Separate Become Available Nutrients under Processing by Acid Colloidal Clay

The research aiming at clay properties alone has shown this soil separate to be the seat of the chemo-dynamics of nutrition of plants (and microbes) growing in the soil. But it required only a few observations and tests of plant growth on colloidal clay media to demonstrate how much more rapidly the colloidal clay could be depleted of some active ions than of others. As much as 85 per cent of the exchangeable potassium was taken by a single legume crop. This suggested the theory of variable plant physiological performances as a result of relatively different rates of fertility depletion for different ions by the same species of plants grown in continued succession on the same soil. This was likewise suggested for a single plant within its seasonal growth period.

It raised the question and hypothesis regarding the chemo-dynamics serving to restore the productivity of soils when "giving the land a rest." It called for the belief in, and the study of, the silt separate as the mineral source of nutrient ions, broken out of these reserve minerals rejuvenating the rested land. It called for the theory that the acid clay may be processing soil mineral fragments just as any acid would. It called up the concept that clay acids were processing limestones to make their calcium and their magnesium active, and processing phosphatic rock to activate the phosphorus. In fact, this theory was the start of the concept of the degree of development of the soil as the major factor in determining the soil fertility and in linking the soil as a potential producer of proteins more closely with the climatic forces developing soils from rocks and minerals.

A long list of theories, and these formulated into experimental tests for research, naturally resulted to concern themselves with the silt fraction of the soil. The silt deposits within the Missouri River bed, the loess deposits constituting the bluffs along that river, and the loessial mantle over glacial till extending northeastward away from the river in the line of the prevailing winds blowing from the Southwest, all suggest themselves as factors in explaining the extended time period during which the Cornbelt soils have maintained their protein-producing capacity. The mineralogy of the soil is now a returning and revived research aim. Professor E. W. Hilgard, author of the early work on soils under date of 1914, recognized at that early date the mineral reserves in the silt more than he did the fertility adsorbed on the clay fraction, as the sustaining fertility of soils under a long period of regular productivity. Aided now by progress in the science of mineralogy, the colloidal clay acid comes into crop production via its action in processing the insoluble mineral reserves for sustaining fertility as well as via the soluble compounds of the starter fertilizers it adsorbs and exchanges to the plant roots.

As the result of the specific aims of soil research just cited, the possible maintenance, then, of soil fertility comes into clearer comprehension when we visualize the chemo-dynamics of the clay fraction. This fraction of the soil serving as the "jobber," is not only an adsorber and exchanger, but is also a processor of the raw minerals to keep the soil's assembly line weathering the

minerals and rocks so that the active inorganic nutrient ions are passed by exchange procedures from them to the clay and from the clay to the plant roots. Going in the opposite direction there is the hydrogen ion, possibly others, generated in the root's colloidal atmosphere by root respiration to be taken by the clay and passed on to the silt fraction where it expands its activities in decomposition of the minerals of this separate.

This concept of the chemo-dynamics delivering nutrient ions to the plant root from the mineral reserves in the soil, makes the climatic pattern of soil development as plant nutrition explain the ecological array of plant species, especially when these as legumes or other plants synthesizing proteins complete for animal nutrition more than mere producers of vegetative bulk are concerned. With an understanding of the wide variations occurring in the suite of nutrient ions active around the plant root, it becomes logical to direct research into the wide shifts in the ratios of carbohydrates to crude proteins and the shifts in the array of different amino acids within the same plant species resulting from the shifts in the ratios of exchangeable ions offered by the colloidal complex of the soil growing the crop. It is also logical to aim some research at the response by the growing animal bodies, by the animal reproductive processes, and by even human physiological processes, according to the varying fertility of the soil growing the feeds and foods by which these higher living forms are supported.

Just what soil research is aiming to do depends on the individual who is aiming. It will depend, not on a majority vote of any scientific body assembled, nor on agronomists grouped according to geographic, agricultural, or economic categories. Rather the aim of research will be higher as the vision of the researcher can be extended by more basic facts at his command for extrapolation of his thinking far enough into the unknown to bring maximum benefit to agriculture and all that is dependent on it.

Peanut Production Trends in North Carolina

(*From page* 10)

it is anticipated that the State average will go up considerably during the next five years. Many estimates have gone as far as saying that the yield will be doubled by 1960.

Ten Steps for Increasing Peanut Yields

1. ***Grow Peanuts in a Rotation:*** A three-year rotation is essential for high yields year after year. In addition to fertility gains, damage from insects, diseases, and nematodes will be reduced. Suggested rotation: cotton, corn, peanuts (small grain can be used). Tobacco and most varieties of lespedeza and soybeans build up nematode infestation. Avoid following peanuts behind one of these crops since peanut nematode infestations have recently been found to be widely distributed in the soils of the peanut-producing area of the State.
2. ***Have Your Soil Tested:*** This is the only way to find out if your soil has an adequate quantity of calcium and potash, the elements most heavily used by the peanut. Don't guess how much your soil needs, have it tested and follow the recommendations.
3. ***Fertilization:*** Where soil tests are made, follow the recommendations. In general, applying adequate amounts of calcium and potash will be sufficient. Calcium needs may be supplied by applying lime prior to planting or by topdress applications of landplaster at early flowering

time. Landplaster does not change the acidity of the soil. Landplaster should always be used in place of lime or potash-lime where the pH is above or approaching 6.3. Potash needs are more difficult to meet since in general there is no response to direct application. The best method of applying potash is to apply it to crops in a rotation preceding peanuts. If this has not been done, other methods would be to broadcast 100-150 pounds of muriate of potash before breaking the land, or to apply on top of the row before peanuts come up. In areas where considerable quantities of a combination potash-lime material are being used, many fields are being over-limed. In most cases it is uneconomical to apply these materials and also dangerous from the standpoint that the soil may be over-limed, resulting in reduced yields.

4. ***Varieties:*** Select a variety that has shown up well in your community. NC-1 and NC-2 have shown up well in all the peanut counties. In addition, NC-2 has shown considerable resistance to Southern stem rot. Many farm stock varieties continue to produce high yields of good quality nuts. Regardless of the variety selected, all seed used for planting should be treated to protect from decay and damping-off organisms. Every 100 pounds of seed should be treated with one of the following materials: Arasan, 3 ozs; 2% Ceresan, 4 ozs; Yellow cuprocide, 4 ozs; Spergon, 4 ozs.
5. ***Spacing:*** Extensive experiments have shown that increases up to 600-800 pounds per acre have been obtained by narrow row spacing with both bunch and runner peanuts. With the bunch variety, the rows should be as close together as can be handled by equipment down to 24 inches. The row width of 42 inches commonly used with runner varieties may be reduced to 36 inches. The final stand with both bunch and runners should be from 7 to 9 inches in the row.
6. ***Cultivation:*** Flat cultivation should be practiced wherever possible since it reduces damage by Southern stem rot considerably. Early cultivation with a rotary hoe is very effective. This machine permits fast cultivation and for best results should be operated at least at a speed of 5 miles per hour. Begin cultivation with a rotary hoe before the plants emerge from the soil and continue at four to five-day intervals until the plants begin to bloom. The use of sweeps with the rotary hoe is more effective in keeping the middles clean.
7. ***Control Soil-borne Insects:*** In areas where soil-borne insect damage is known to be severe, insecticides should be applied to the soil. The use of Aldrin or Heptachlor at the rate of 2 pounds and 1½ pounds per acre respectively has resulted in increased yields and improved nut quality. For best results, this material should be applied before the first cultivation. It can be applied either in granular or dust form. The material must be thoroughly mixed with the soil in the fruiting zone. Forty pounds of 5% dust or 100 pounds of 2% dust is sufficient to treat one acre.
8. ***Apply Landplaster Early:*** As an insurance factor against "pops," the use of 400 pounds of landplaster per acre is recommended. This material should be broadcast directly on the plant. Cover the entire row. Landplaster is neutral and does not change the acidity of the soil. It is a quickly available source of calcium and must be placed on the soil when peanuts are forming to be most effective. Since calcium is not translocated in the plant, landplaster applied on one side of the plant will have very little effect on the nuts forming on the other side.
9. ***Dust for Leafspot Control:*** Use 325 mesh sulfur or 325 mesh sulfur

plus 4% copper at the rate of 20 pounds per application. The first application, July 1-10, with two more aplications at 14-day intervals. Dust washed off within 24 hours, should be repeated as soon as possible. To obtain greatest returns, the fields of dusted peanuts should be harvested 7 to 10 days later than the undusted plants. Vines should be wilted at least one-half day and free from rain and dew when stacked.

10. ***Harvesting:*** Use all labor-saving devices adaptable to your conditions. Many of the diggers on the market will do a good job of digging and stacking. Use good stack poles with slats 15 to 18 inches off the ground to hold peanuts up and allow air circulation. Permit vines to wilt before stacking. Hay and nuts will cure faster and brighter. New mechanical methods for harvesting hold great promise for reduction in labor in the near future. With most varieties, under normal conditions, it has been found that a period of 5 to 5½ months is required for peanut production. This means that peanuts planted the first of May will be ready for harvest during the first part of October. Unusual weather conditions will change this period to some extent. But in all cases, representative plants in the field should be examined at frequent intervals near the harvest time. And harvesting should not begin until the maximum number of pods are mature.

Fertilizers Give Life to Tired Orchards

FERTILIZERS can do a lot to put life back into a tired orchard, according to tests under way in Door County, Wisconsin. Frank Gilbert, Supervisor of the Branch Agricultural Experiment Station at Sturgeon Bay, reports that a complete fertilizer has perked up orchards in that area.

Gilbert reports that fertilizers make apple trees grow faster and generally improve the size of the fruit. Adequate fertilization produces darker green leaf color, thicker leaves, more terminal growth, much larger fruit buds, good fruit size and finish, and better fruit color. Combinations of nitrogen-phosphorus-potash were better than nitrogen alone. Mulching sometimes seems to make fertilizers more available.

The orchards in these fertilizer tests were generally "problem" orchards. One, in particular, was so poor that the owner was considering selling or clearing it. The fruit set was very light, there was almost no terminal growth, and the leaves were small and discolored. Gilbert started the fertilizer program in this orchard in 1950. The trees aren't recovered completely yet, but the orchard looks a lot better than it did. He has started similar tests in the Bayfield area.

Potassium fertilizers can correct "curl leaf" in young cherry trees within one or two seasons, Gilbert says. Cherry curl leaf has been corrected by applications of 0-0-60 fertilizer plus ammonium nitrate. With only nitrogen fertilization, curl leaf became more serious.

There's also some indication that phosphorus in the fertilizer is helpful. During the two years of the tests, trees receiving some phosphorus along with the nitrogen and potassium have grown somewhat better than trees that received only nitrogen and potassium.

Complete Program Needed for Top Yields

FERTILIZERS alone will not give you maximum production on your farm. Combine them with good soil management practices for top yields.

A. L. Lang, Agronomist at the University of Illinois, explains good management as including lime, legumes, manure, and plenty of plant food. He says such a program has increased corn yields as much as 69 bushels an acre on Illinois soils.

In tests during the past four years, corn yields averaged 91 bushels an acre in a livestock system of farming when good management was practiced on six light-colored soils. This was 69 bushels over untreated land, which averaged 22 bushels an acre. Grain systems on the same fields resulted in an increase of 62 bushels an acre.

On seven dark-colored soils, good soil management increased yields from 56 to 109 bushels an acre. In grain systems the yield was 100 bushels even.

In 68 farmer trials over a three-year period, Lang reports that fertilizer applied hit or miss gave an increase of 22 bushels an acre. The treatment included 80 pounds of nitrogen an acre. This increase is, of course, profitable. However, Lang says farmers are often satisfied with this relatively small increase and fail to cash in on the big money by not putting all scientific knowledge to work in a complete, over-all management program.

Well-managed Farms Will Be Profitable

BARRING catastrophe, well-managed farms will be profitable in 1954 in spite of fears raised by surpluses, lower prices, and high costs.

Economic conditions are important, of course, but the most profitable adjustment for the Illinois farmer this year is the same as always—adjustment of his crops to the quality of his land.

P. E. Johnston, University of Illinois farm economist, reports that's what a study of hundreds of Illinois farm records show. He offers one guiding principle to follow in making this adjustment: Grow as many acres of the highest value crops as your farm can stand and yet keep erosion under control.

According to the records, corn has the highest value, followed in order by soybeans, clover, wheat, and oats. At prices expected in 1954, you can look for about these profits per acre: $30 for 70-bushel corn, $24 for 32-bushel soybeans, $10 for two-ton clover, $9 for 29-bushel wheat and $4 for 48-bushel oats.

Profits are figured on $1.35 for corn, $2.30 for soybean, $22 for clover hay, $1.80 for wheat and 70 cents for oats. Johnston figures profits on the basis of records kept by cooperators in the detailed cost research project at the University, which has been continuous since 1912.

Profit, he says, is the income left after paying all costs for labor, management, and fertilizer to replace plant foods used by the crops, plus all expenses for machinery and land.

A New Spray . . .

(*From page* 14)

Fig. 3. Chlorotic sorghum growing on alkaline calcareous soil. A 20-foot length of the row in the center of the picture was sprayed with citric-iron sulfate solution. It was severely chlorotic before spraying.

luctant to advise acidulation. An orchard or field crop is rarely completely chlorotic. This is illustrated in Figure 1. This photograph shows a field of sorghum in which the three rows in the center of the picture are badly chlorotic while on both the left and right there is little or no chlorosis. In such cases the cost of treating the whole field, before planting, let us say with one ton of sulfur per acre, would involve an unreasonable expense just to cure a condition in a limited area. Chlorosis is also often limited to seasonal variations and appears only at certain times of the year.

That heavy sulfur applications can be successful in some cases in illustrated in Figure 2. The crop here is Boer love grass. The border on the left was treated with one ton per acre of sulfur. The border on the right is a check, untreated, area. Even in this case where the comparison is so striking there are certain times of the year when the untreated plants, on the right, show practically no chlorosis.

Sprays

In view of the above highly involved problems many have abandoned soil treatments, on a field scale, in favor of sprays. Spraying the leaves with dilute solutions of micro-nutrient element salts has proven successful in many instances although the cure is only temporary. The citrus industry in Florida and the pineapple industry in Hawaii are outstanding examples.

In Arizona, sprays have not given satisfactory or encouraging results and this is believed to be due to the arid

climate. Spray solutions fail to stick on the leaves or to spread thoroughly over the leaf surface.

New Type of Spray

From a study of this problem a new kind of spray has been developed and it has been tried with great success on a number of chlorotic plants. Tests have been made as occasion arose since 1945. The base solution of this spray is a per cent citric acid solution containing a trace of detergent as spreader. To this base solution 1 per cent iron sulfate, 0.5 per cent manganese sulfate, and 0.25 per cent zinc sulfate are added but in most cases, in Arizona, only the iron sulfate is needed. The amount of citric acid or micro-nutrients may be varied if too strong or too weak for some plants. Also in some severe cases of chlorosis more than one spraying may be necessary.

Citric acid buffers the spray solution at a weakly acid reaction, develops a syrupy adhesive consistency as it spreads and dries, and appears to enhance entry into the leaf tissues. When citric acid is not added to the spray solution, the solution either does not stick to the leaves or it forms into balls or bubbles on the surface of the leaf.

Ordinary spray solutions have been particularly unsuccessful with plants belonging to the grass family. An example of the efficacy of the spray containing citric acid is illustrated in Figure 3. This represents a badly chlorotic field of sorghum in which about 20 feet of the middle row, shown in the picture, was sprayed once with a solution containing 1 per cent citric acid and 1 per cent iron sulfate to which a trace of detergent had been added. This single spray treatment changed these plants from chlorotic to dark green. This represents the first case in which we have obtained a response on sorghum in Arizona with spray solutions.

Make Mine Milk

(*From page* 5)

tween butter and margarine. Also involved is the fact that margarine quality has been improved and the prohibition against the sale of yellow margarine exists only in Wisconsin and Minnesota, leaving the big centers of population without these trade restrictions.

If and when, on the other hand, promotional results can be obtained for the whole milk industry similar to those which have boosted the consumption of solids-not-fat, we may begin to see a far more encouraging situation develop. This country now uses more than 70 per cent of the non-fat solids in the total milk produced for human consumption. Prior to World War II not more than 50 per cent was sold to consumers, over half of the solids being fed to calves, pigs, and chickens.

Four years ago national distribution of non-fat dry milk solids in convenient consumer packages began and a vigorous educational effort kept step with the merchandising. By 1953 about 100 million pounds of this product of the cow were taken off the shelves.

It wasn't spoken about so loudly then, but in 1947 and 1948 the dry milk business had been swollen by war demand so much that the government actually bought about one third of the total output of non-fat dried milk solids. It might well have been the only fair thing to do. The government encouraged tremendous dairy plant expansion in the powdered field during the war years, remember.

Traditionally and emotionally, the average dairyman and his processors have been dead set against much if any government barging into their baliwick. They were used to such programs as eradication of tuberculosis (after they got converted to the need) and later, brucellosis control. But this

last malady led to a wholesale slaughter of dairy cows in 1934-35 under a newly hatched plan to start with Bang's disease where they left off with TB. Soon after World War II began, dairymen vehemently opposed taking special checks from the government as incentives and as partial replacement of feed costs, and they hated the idea of subsidizing fluid-milk consumers on a few big fluid-milk markets. However, they finally bowed to custom and dire necessity and accepted the so-called bonus with a wry face.

From then on the die was cast. Except for five years during World War II and part of 1948, purchases of dairy products to maintain price supports have been made by the government. It had one feature as a workable item of value at the time. This was the food-stamp plan, wherein about 70 million pounds of butter were disposed of to needy families just as the war opened. The penny-a-pint school-milk program was also begun in May 1940. In the last instance the milk habit for schools has been adopted with success by the National School Lunch so that large amounts of surplus dairy wares have been utilized in the best and most approved fashion.

Every dairyman I have met wants his product used, not stored away to deteriorate and lose value while people forget the milk and butter habit. Yet he has heavy investments and such high producing cattle on good feed and pasture that he simply can't "let go" and quit. He was reared in the old-fashioned belief that it is good to provide an abundance. He is having a darn tough time trying to unlearn that ancient doctrine.

He wonders and has considerable tendency to pin high hopes upon the baby crop with its 7,000 new mouths to feed every single day in this country. But meanwhile he has calf crops coming on also and pressing debts to defray and immediate dilemmas to meet and solve. He can't kid himself along on wishful-thinking statistics, much as he feels that

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Maybe he hears some sure-shot wiseacre propose that we attack the surplus butterfat problems by working to breed a strain of dairy cows that will test about 2 per cent butterfat on normal yields of milk. He laughs that one off because he feels that new discoveries are still going to be made that will prove the great superiority of milk fat over vegetable oils, and he isn't ready yet to throw in the sponge and begin to crawfish. He won't buy any negative program. He's seen them fail before.

The worst punishment in this sagging dairy picture—if it lasts—will fall on the poorest prepared and equipped milker on one hand and the dairyman with an extremely high, rigid investment in facilities. The fellow without much chance to turn his talents elsewhere and the chap at the other extreme, who has plunged deeply and needs a firm price as well as heavy volume to exist well, these may be the ones that finally cut some off the surplus. But who will buy their cows—the butcher or another dairyman?

THE old wheeze that we hear so much—more efficiency and greater economy—has been dinned at dairymen so often that they can't get any thrills out of this oft-mentioned adjustment. There are just too many forces operating in the direction of bigger milk flow to make the "cheaper production" route look like a bonanza.

It isn't merely the dairy farmer who is tied up in this new puzzle picture. Whole communities and vast industries are likewise much involved. They rise or fall with him, and so does the soil itself. Soil conservation is a partner of livestock enterprises, a far closer one than with grain or cotton or tobacco. What happens to the welfare of the dairyman must sooner or later be evident in his soil. If some plan might be devised that would offer incentives for soil maintenance as a requirement in our programs, there is a chance that the fretting over parity levels would diminish.

As it is, the payment of firm support prices for crops that make up the working tools of a livestock feeder imposes certain hardships on the latter. Dairymen realize that and maybe it's the chief reason why they don't like to take 75 per cent when the grain grower can get 90 per cent of parity. This kind of a division of attitudes and objectives doesn't seem to be the nicest sort of situation for agriculture.

I am glad to note that my dairy friends, for the most part, have abandoned their old, silly ideas about meeting active competition, which is perhaps one deep root they must dig out. In former times it was seldom thought advisable to tell the cream producer frankly that his product stank to high heaven, and that the new competing spread was not axle grease or filthy stuff, but a wholesome food that had come to stay.

Finally, he has learned the lesson so long held away from him by his leaders. He is organized to produce excellent manufactured products and has a force of trained people to sell it for him on a national scale. He has quit the backwoods era of suspicion and provincialism and emerged as a gifted and well-trained producer of just about the most invaluable food we now produce for human use.

If I knew the dairyman less throughly and had less faith in his integrity and ability to make adjustments against grave and perplexing problems, this would be an hour of discouragement for me. On the contrary, I believe that the future carries more rich promise for the producer of high-grade milk than any of the progressive years that have passed since the real dawn of dairying in the 1890's. This roadblock that stops the milkman for the moment will soon be removed. And he will do it largely on his own initiative and courage—not on free advice and political shenanigans.

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THE AMERICAN POTASH INSTITUTE

1102 16th STREET, N. W. WASHINGTON 6, D. C.

A farm boy said to his brother, "Reuben, how would you get a girl to marry you?"

Reuben answered, "Well, if she don't want to, you can't; but if she does, there ain't hardly no way to prevent it."

* * *

The bar was crowded with Martini drinkers. After quite a few rounds, one of the customers suddenly staggered, turned and fell flat on the floor. "That's what I like about Joe," remarked one of his companions, "he always knows when he's had enough."

* * *

An elderly man sat on the park bench, muttering to himself. Anxious to be helpful, a second bench sitter said: "You seem terribly worried. Can I help you?"

"Oh, my, no. Excuse me, please," explained the old gent. "I didn't realize . . . it's just that, well, for 20 years after World War I, we tried to get things back to normal; and ever since World War II, I've been bothered by two great fears. First, that things may never get back to normal; and second, that they already have."

* * *

A Scottish undertaker, irritated by his slow payers, telephoned to one of them who had not paid the last instalment on his mother-in-law's funeral and said: "See here, if that five shillings isn't paid on Saturday, up she comes."

"I wouldn't worry so much about that girl if I were you," the man consoled his friend. "Remember when a woman says 'No' she means 'Maybe.' And if she says 'Maybe' she means 'Yes.' "

"I know," replied the other, "but what does she mean when she just says "Fooey?' "

* * *

During his speech, a politician noticed an old lady down front who appeared most interested in his words. Afterwards, he greeted her and solicited her vote.

Looking him in the eye, the old lady said, "Well, sir, you are my second choice."

The politician thanked her and asked cheerfully, "Who is your first choice?"

"Oh," she replied, 'just anybody."

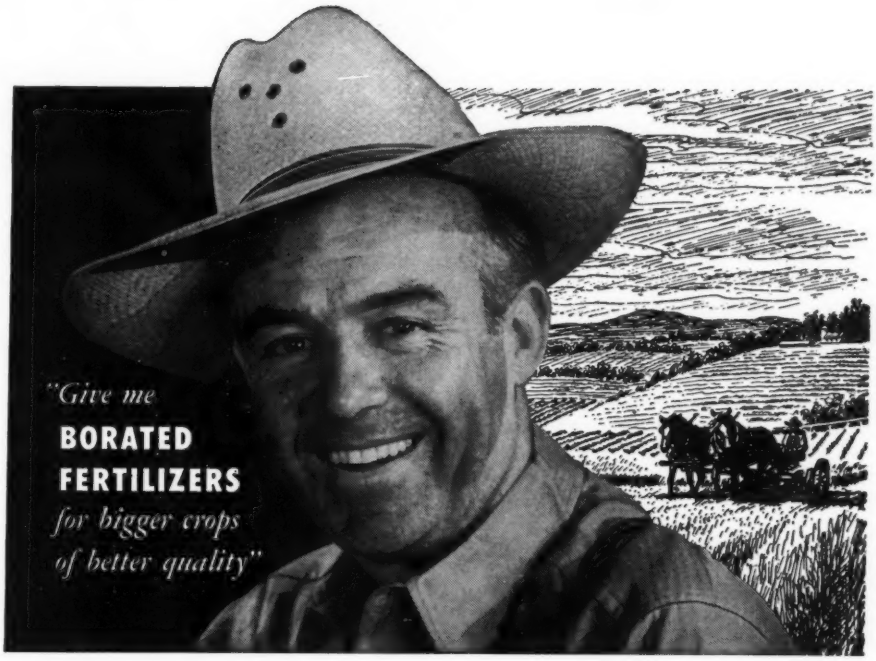
* * *

He was one of those tourists who liked to brag about the number of miles covered in a day. As the evening wore on they passed motel after motel with the "No Vacancy" sign out. Finally, the little woman remarked, "I know we'll find one soon, dear . . . people are starting to get up."

* * *

Sailor—"Hiya, Babe?"

Girl—"Sir, just because you are in uniform, don't think you can make friends on a public street with a strange girl who lives at 1746 Mishmosh Avenue, telephone Main 1802."



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